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Report of VESIAC

A BIBLIOGRAPHY OF SEISMOLOGY FOR PROJECT VELA

Final Edition

VESIAC STAFF

VOLUME I

June 1971

ADVANCED RESEARCH PROJECTS AGENCY

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Report of VESIAC

A BIBLIOGRAPHY OF SEISMOLOGY FOR PROJECT VELA

Final Edition

Edited by

VESIAC Staff

June 1971

Geophysics Laboratory

Willow Run Laboratories

THE INSTITUTE OF SCIENCE AND TECHNOLOGY

THE UNIVERSITY OF MICHIGAN

Ann Arbor, Michigan

PREFACE

VESIAC (VELA Seismic Information Analysis Center) was an information collection, analysis, and dissemination facility established at the Institute of Science and Technology of The University of Michigan. During the period December 1960 to June 1971 the center operated under a contract sponsored by the Advanced Research Projects Agency under the Office of the Secretary of Defense.

The purpose of VESIAC was to analyze the research information related to the VELA UNIFORM Program of Project VELA and to function as a central facility for this information. The facility served all authorized recipients of VELA UNIFORM research information by issuing subject bibliographies with abstracts and special reports as required. In addition, VESIAC periodically summarized the progress of the research being conducted.

VESIAC operated under the technical direction of the Geophysics Laboratory of the Institute. In its operation VESIAC drew upon members of this laboratory and other members of the Institute and the University.

ABSTRACT

The final edition of A Bibliography of Seismology for Project VELA lists authors and titles and gives abstracts for articles and reports on seismology and the detection of underground explosions. The list of authors and titles is arranged by areas of the VELA Uniform program of the Advanced Research Projects Agency.

CONTENTS

NOTE TO USERS

In November 196?, VESIAC published A Bibliography of Seismology for the VELA UNIFORM Program, Report No. 4410-10-B, which was followed by five quarterly addenda. A second edition, Report No. 4410-81-B, containing abstracts for approximately 2000 articles and reports on seismology and the detection of underground explosions was published in July 1965. For the second issue, the entries in the bibliography and all five addenda were edited and integrated along with approximately 200 new entries.

The final edition does not repeat previously published data, but contains only reports received since the second edition. It has three main parts, a subject outline, an author-title listing by subject and a listing of author-title-abstracts by author. Publications with no author credits are listed under the names of their corporate authors.

VESIAC acquisition numbers and DDC numbers (where known) are printed in the margin to the left of each reference. Documents with a DDC number are procurable directly from DDC. The letters "VU" following a VESIAC number indicate that the document was written under a VELA UNIFORM contract. OFFICIAL USE ONLY documents are referenced without an abstract.

DIRECTIONS FOR EFFECTIVE USE

1. To select areas of interest, consult the Subject Outline, Section 1.
2. Next refer to Section 2, where the Subject Outline is repeated, with the author and title of each abstracted article, book, or report listed alphabetically under the appropriate subject heading.
3. Then turn to Section 3, where the abstracts are arranged alphabetically by author.

I

SUBJECT OUTLINE—PROJECT VELA UNDERGROUND

I RESEARCH IN SEISMOLOGY

A. Seismic Instrumentation

1. Short Period Seismographs
2. Long Period Seismographs
3. Strain Seismographs
4. Deep Well (borehole) Seismographs
5. Ocean Bottom and Offshore Seismographs
6. Experimental Seismographs
7. Unmanned Seismographs
8. Time Systems
9. Amplifiers
10. Recorders
11. Filters
12. Data Acquisition and Signal Transmission Systems
13. Miscellaneous

B. Station Location and Operations

1. Stations Listings and Instrumentation

a. World-Wide Standard Seismological Network
b. VELA Seismological Observatories
c. Long Range Seismic Measurement (LRSM) Stations
d. Regional or National Seismograph Networks

(1) U.S.
(2) Foreign

e. Large Aperture Seismic Arrays
f. Unmanned Seismological Observatory
g. Others

2. Operational Procedures
3. Instrument Calibration and Response Data
4. Seismological Bulletins
5. Miscellaneous

C. Ambient Seismic Noise

1. Theory
2. Temperal and Spatial Characteristics

a. Short-Period (<5 sec)
b. Long-Period

3. Measurement Techniques
4. Measured Levels
5. Sources
6. Correlation with Station Geology and Environmental Factors
7. Miscellaneous

D. Signal Enhancement and Noise Reduction

1. Theoretical Studies
2. Instrument Emplacement and Techniques

3. Seismic Arrays
   a. Short-Period
   b. Deep-Well (borehole)
   c. Long-period
   d. Large Aperture Seismic Arrays (LASA)
   e. Array Design and Site Selection Criteria
4. Combined Strain - Pendulum Seismographs
5. Analog and Digital Processing Techniques
6. Miscellaneous

E. Seismic Detection
1. Definition of Detection Threshold and Probabilities
2. Single Station and Array Threshold Studies
3. Network Design and Capability Studies
4. Automatic Detection Schemes
5. On-line Data Acquisition and Detection Systems
6. Automated Seismic Bulletins
7. Wave-time Identification Techniques
8. Seismic Sensor and Site Selection Criteria
9. Miscellaneous

F. Seismic Location
1. Computer Methods for Hypocenter Determinations
2. Statistical Techniques for Estimating Errors in Epicenter and Focal Depth
3. Network Capability Studies
4. Single and Multiple Array Capability
5. Calibration of Teleseismic Network
6. Travel-Time Tables
7. Travel-Time Anomalies
8. Depth Determination

G. Seismic Source Identification
1. Theoretical Basis for Identification Techniques
2. Development and Evaluation of Identification Aids
   a. General
   b. Short-Period
   c. Long-Period
   d. Source Depth
   e. Local Seismicity
3. Statistical Procedures for Joint-use of Identification Aids
4. Single Station and Array Threshold Studies
5. On-line Identification Scheme
6. Miscellaneous

H. Seismic Magnitude and Energy
1. Definitions and Magnitude Scales
2. Computational Methods for Body Wave and Surface Waves
3. Amplitude-Distance Curves
4. Energy Partition
5. Station Corrections
6. Miscellaneous

I

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I. RESEARCH IN SEISMOLOGY

A. Seismic Instrumentation

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2. Long Period Seismographs
3. Strain Seismographs
4. Deep Well (Borehole) Seismographs
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6. Experimental Seismographs
7. Unmanned Seismographs
8. Time Systems
9. Amplifiers
10. Recorders
11. Filters
12. Data Acquisition and Signal Transmission Systems
13. Miscellaneous

B. Station Location and Operations

1. Stations Listings and Instrumentation

a. World-Wide Standard Seismological Network
b. VELA Seismological Observatories
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d. Regional or National Seismograph Networks

(1) U.S.
(2) Foreign

e. Large Aperture Seismic Arrays
f. Unmanned Seismological Observatory
g. Others

2. Operational Procedures
3. Instrument Calibration and Response Data
4. Seismological Bulletins
5. Miscellaneous

C. Ambient Seismic Noise

1. Theory
2. Temperal and Spatial Characteristics

a. Short-Period (<5 sec)
b. Long-Period

3. Measurement Techniques
4. Measured Levels
5. Sources
6. Correlation with Station Geology and Environmental Factors
7. Miscellaneous

D. Signal Enhancement and Noise Reduction

1. Theoretical Studies
2. Instrument Emplacement and Techniques

I. Seismic Propagation Phenomena

1. Theoretical Studies

   a. Body Wave
   b. Surface Wave

2. Model Studies
3. Empirical

   a. Body Wave
   b. Surface Wave

4. Travel-Time Curves
5. Geophysical Constants
6. Ray Tracing Techniques
7. Transfer Function
8. Miscellaneous

J. Crustal and Mantle Structure

1. Theoretical Earth Models
2. Seismic Refraction Studies

   a. U.S.
   b. North American Region
   c. Foreign Regions

3. Surface Wave Studies
4. Mantle and Core Structure
5. Correlation of Seismic Data with Geophysical Parameters
6. Test Sites and Recording Sites
7. Miscellaneous

K. Earthquake Source Mechanisms

1. Theoretical Studies
2. Model Studies
3. Fault-Plane Solutions for P and S Waves
4. Radiation Pattern from Surface Waves
5. Foreshock and Aftershock Sequences
6. Source Dimension
7. Special Earthquakes
8. Miscellaneous

L. Seismicity

1. World
2. Regional

   a. U.S.
   b. Other

3. Microearthquake Studies
4. Earthquake Triggering Mechanisms
5. Miscellaneous

M. Explosion Phenomena

1. Computational Models
2. Rock Mechanics
3. Model Studies
4. Shock Wave Propagation
5. Decoupling Experiments
6. Seismic Coupling and Media Effects

I

AUTHOR TITLE LISTING BY SUBJECTS

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I. Research in Seismology

A. Seismic Instrumentation

3. Strain Seismographs

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A. Seismic Instrumentation

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I. Research in Seismology

A. Seismic Instrumentation

7. Unmanned Seismographs

GEOTECHNICAL CORP. (STAFF), Unattended Seismograph Unit.

SANDIA LABORATORIES (STAFF), Unattended Seismological Observatory.

I. Research in Seismology

A. Seismic Instrumentation

8. Time Systems

LINCOLN LABS., MIT. (STAFF), Large Aperture Seismic Array (LASA) - Timing System.

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I. Research in Seismology

A. Seismic Instrumentation

9. Amplifiers

KEELE, J. E., Development of Low-Power Low-Noise Phototube Amplifier.

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I. Research in Seismology

A. Seismic Instrumentation

10. Recorders

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I. Research in Seismology

A. Seismic Instrumentation

11. Filters

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I. Research in Seismology

A. Seismic Instrumentation

12. Data Acquisition and Signal Transmission Systems

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I. Research in Seismology

A. Seismic Instrumentation

13. Miscellaneous

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I. Research in Seismology

B. Station Location and Operations

1. Stations Listings and Instrumentation

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B. Station Location and Operations

1. Stations Listings and Instrumentation

b. VELA Seismological Observatories

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LEICHLITER, B. B., Operation of TFSO.

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SMETANIN, D. A., "The Hydrochemistry of the Region of the Kurile-Kamchatka Trench II. The Hydrology and Chemistry of the Upper Subarctic Water in the Region of the Kurile-Kamchatka Trench," Akademia Nauk SSSR Trudy Instituta Okeanologii.

SOVIET GEOPHYSICAL COMMITTEE (STAFF), Report on Scientific Activity in Seismology and Physics of the Earth's Interior in 1960-1962, Soviet Geophysical Committee, Academy of Sciences of the USSR.

STERLYAGOVA, G., "The Tectonics of the Southeastern Part of the Caspian Sea According to Marine-Seismic Data," Razved. I Promysl. Geofiz.

STOLEN, O., "A Collection of Norwegian Newspaper Clippings."

SUVOROV, A. I., "The Main Faults of Kazakhstan and Central Asia," Akad. Nauk SSSR, Geol. Inst., Trudy.

UDINCEV, G. B., "The Relief of the Kurile-Kamchatka Trench," Trudy Instituta Okean. Acad. Sci.

UNIV. OF PARIS (STAFF), Activity Report of the Physics Laboratory of the Ecole Normale Superieure - Seismology, Univ. of France, Paris, France, 1966.

VINNIK, L. P., "The Structure of Four- to Six-Second Microseisms," Doklady Akad. Nauk SSSR.

ZAKASHANSKII, M. S., "Density of the Meso-Cenozonic Deposits in the West Siberian Plain," Prikladnaya Geofizika.

ZATONSKII, L. K., V. F. KANAEV, and G. B. UDINTSEV, "Geomorphology of the Underwater Part of the Kurile-Kamchatka Chain," Oceanologyial Investigations.

3
ABSTRACTS

ABLOW, C. M., Y. D. S. RAJAPAKSE, and M. W. EVANS, An Analysis of the Shock Initiation of Granular Explosives by the Gas Compression-Conduction Mechanism, Rept. No. AFOSR 65-2308, Contract AF 49(638)-1124, Stanford Res. Inst., Menlo Park, Calif., 1965.

VESIAC 14.684 VU
AD 628 033

The role of the gas compression-conduction mechanism in shock initiation of granular materials was studied by analyzing the dependence of grain surface temperature on the magnitude of the shock and the relative sizes of grain and surrounding volume of interstitial gas. A temperature of the shocked interstitial gas computed by a one-dimensional, two-shock model, serves as initial gas temperature condition for the heat conduction problem of a spherical cold grain in a spherical shell of hot gas enclosed in a semi-infinite solid cold spherical wall. Discussed are: initial and maximum temperature of the grain surface, and correlation of results of the heat conduction solution in terms of dimensionless parameters.

ABRAMOVICI, F., Diagnostic Diagrams and Transfer Functions for Oceanic Wave-Guides, Contract AF 49(638)-1388, University of California, La Jolla, California, 1967.

VESIAC 16,733 D VU

The variation of frequency as a function of wavenumber and the associated spectral transfer function are computed for different modes in a complex oceanic wave-guide. The model consists of a fluid layer resting upon a three-layer elastic half-space. The layers and the half-space are homogeneous.

The comparison of theoretical results with measured power spectra for two records taken in the Pacific Ocean shows qualitative agreement stressing strongly the role of the leaking compressional organ-pipe modes which are not continuations of normal modes beyond cutoff frequency.

ABRAMSON, N., Further Considerations in the Use of Large Seismometer Arrays, Contract No. AF 19(628)-500, Mass. Inst. of Tech., Cambridge, Mass., 1963.

VESIAC 7015 VU
AD 424 594

The problem of estimating signal waveform and time delays in an array of seismometers is considered. Using the model of Levin, Green and Kelly a matrix form of their solution is obtained. An expression for the asymptotic variance of the estimate of vector delay is obtained and an equation is derived relating this variance to the placement of seismometers. Two general factors affecting the estimate of wave delay are important in determining the distance between seismometers in a linear array. If the distance is large the aperture of the array is large thus decreasing the variance of our estimate. If the distance is small the noise correlation from seismometer to seismometer may be used to decrease the variance. Analysis shows that the former factor is more significant than the latter.

ADAIR, R. S., Operation and Maintenance Manual for the Solion Universal Seismometer, Technical Memorandum, Rept. No. CGS-1198-66-1, Contract CGS-1198, Univ. of Texas, Austin, Texas, 1966.

VESIAC 14,972 VU

The Solion Universal Seismometer, which is fully described and illustrated in this report, can be used to detect either vertical or horizontal earth motion. It may be used in short-period or long-period applications with adjustable period range as determined from the solion transducer and the filter circuit. It operates with the solion operational amplifier, DRL Model 101, which provides a low impedance single-ended source for operation with any suitable high impedance recording device. The amplifier provides a load circuit, operational amplifiers with adjustable gain control, and plug-in filter circuit boards to shape the response of the amplified signal.

ADAMS, W. M., J. W. HAWES, and N. L. NUHN, Final Rept. to Defense Atomic Support Agency, Contr. No. DA-49-146-XZ-186, Planetary Sci. Inc., Santa Clara, Calif., 1964.

VESIAC 8300 VU
AD 442 907

Methods for analyzing digitized strong-motion seismograms have been developed. These techniques have been programmed for one of three electronic digital computers, the IBM 1620, CDC 1604, or IBM 7094. The codes have been debugged and checked by manual calculations or test problems, then used to run production on existing data. Emphasis has been on utilization of the general frequency and time-dependent aspects of the entire trace. An attempt to use numerical-control machining for generation of complex ultrasonic methods has been unsuccessful but the approach merits continued effort.

ADLUNG, A., "Intensity Determination of Seismic Tremors by Means of Simple Instruments and Their Relation to Magnitude," Geofysikalni Sbornik, No. 155, pp. 311-353, 1961, (Translated from Czechoslovakian), Contract SD-78.

VESIAC 7723 VU

The problem of an intensity determination of macroseismic vibrations was considered. After a discussion of "absolute scales," the case of the intensity determination with overturning objects was treated experimentally, with the aid of a shaking table with impact excitation. An intensity determination by overturning objects is not possible; the moment of overturning is not sufficiently defined because of shaking oscillations. Also, it was found that the damaging effect of a vibration is not proportional to the acceleration but to the ground motion velocity. Furthermore, a method was described by which it is possible to determine the intensity from the ground amplitude. A vibration meter for this purpose has been developed.

ADLUNG, A., "Seismic Observations on Contained Explosions," Gerl. Beitr. Geophys., Vol. 65, No. 1, pp. 1-10, 1955, (Translated from German), Contract SD-78.

VESIAC 6030 VU

Twenty three contained explosions in the Saxony-Thuringia area, as well as in Northern Bohemia, are subjected to an analysis. Although the explosion times are not accurately known, it is possible to plot the travel-time curves for 4 profiles. The velocities determined are within the scope of those found otherwise for contained explosions. Only the velocities in the gabbro zone, which are higher than those found previously in Germany, are an exception. A small energy transmission from the Harz and a travel time decrease during explosions on the right bank of the Elbe are the only peculiarities. Reference is made to the need of making systematic observations during contained explosions.

ADVANCED RESEARCH PROJECTS AGENCY (STAFF), Large Aperture Seismic Array - First LASA Systems Evaluation Conference held 14-16 September 1965, Contract: Agency Document, Advanced Research Projects Agency, Washington, D. C., 1965.

VESIAC 13,858 VU
AD 648 415

The material contained in this report consists of a compilation of the papers presented at the first LASA Systems Evaluation Conference. The conference was intended to serve three purposes: (1) to acquaint all of the organizations currently participating in the program with the status of the work; (2) to attempt to formulate the prototype station and network specifications; and (3) to provide a record of the project activities in the conference report. Twenty-three technical papers are presented plus the following: (1) Summary of Station Parameters; (2) Summary of LASA Processing Requirements; (3) Summary of LASA Station Data Storage Requirements.

ADVANCED RESEARCH PROJECTS AGENCY (STAFF), The Role of Seismic Arrays in the Detection of Underground Nuclear Tests, Project VELA-UNIFORM, Contract No. Agency Document, Advanced Research Projects Agency, Wash., D.C., 1963 (OFFICIAL USE ONLY).

VESIAC 7351 VU O
AD 428 809

ADVANCED RESEARCH PROJECTS AGENCY (STAFF), Summary of Seismic Results of the ANTLER, FISHER and HARDHAT Underground Nuclear Explosions in Nevada, Contract ARPA Agency Document, Advanced Research Projects Agency. Wash., D. C., 1962 (OFFICIAL USE ONLY).

VESIAC 8236 VU O

AFIN, J. M., Exploratory Meeting on the Magnetic Tape Recording of Seismic Data, Research Paper P-210, Contract SD-50, Inst. for Defense Analyses, Washington, D. C., 1965.

VESIAC 14,954 VU
AD 625 199

An exploratory meeting to discuss the magnetic tape recording of seismic data was held on August 18, 1965, under the sponsorship of the Inst. for Defense Analyses. This report summarizes the proceedings of the meeting. The problems of obtaining magnetic tape records of seismic data over a relatively wide bandwidth (up to 10 cps) with large dynamic range are reviewed, and current seismic tape recording capabilities are surveyed.

AGALAROV, D., "On the Propagation and Reflection of Nonlinear Visco-elastic Waves," Izv. Akad. Nauk. Azerb. SSR, Fiz. Tekhn. Mat., No. 5, pp. 13-19, 1964. (Translated from Russian). Contract DA-49-083 OSA-3137.

VESIAC 13,314 VU

Media are examined whose mechanical properties are described by nonlinear relations which unite their elastic-plastic and viscous properties. Approximated analytical solutions are obtained which take viscous properties into consideration in a first approximation for problems of propagation and reflection of waves in a rod, and for the propagation of spherical waves.

AHRENS, T. J., Dynamic Properties of Rocks, Tech. Summ. Rept., Contract No. DA-49-146-XZ-277, Stanford Res. Inst., Menlo Park, Calif., 1964.

VESIAC 8396 VU
AD 444 302

Measurement of the strain-rate associated with elastic stress relaxation (material dissipation function in Duvall's theory) can be achieved by obtaining the decrease with propagation distance of peak elastic stress and the accompanying stress gradient. Second, results are given for Hugoniot measurements on single and polycrystalline quartz in the unexplored 280- to 410-kbar range, verify the 16% volume decrease inferred from Wackerle's data, and indicate (for isentropic expansion) that upon relief of pressure the material has a specific volume between that of coesite and stishovite. Third, an optical lever shock reflection technique was developed for determination of adiabatic release paths from final and intermediate shock states.

AHRENS, T. J., Dynamic Properties of Rocks, Sci. Rept., Contracts: AF 19(604)-8419, DA 49-146 XZ 277, Calif. Inst. of Tech., Pasadena, Calif., 1968.

VESIAC 19,301 C VU

Rocks and rock-forming minerals exhibit dynamic yielding under one-dimensional shock stresses varying from several kbars to approximately 100 kbars. The dependence of the dynamic yield point, or the Hugoniot elastic limit, on mineralogy, porosity, and grain size in multimineralic rocks has not yet been studied. For shock stresses greater than the Hugoniot elastic limit, the achieved states lie along the deformational portion of the Hugoniot curve. Although non-porous rocks shocked to states along the deformational Hugoniot are often assumed to behave as fluids or elasto-plastic solids, few data as to their actual rheological behavior in this stress range are available.

AHRENS, T. J., Stress Wave Propagation in a Prestressed Medium, Final Sci. Rept., 1 June 1966 Through 31 July 1967, Rept. No. SRI-PGU-6099, AFCRL-67-0529, Contract AF 19(628)-6048 ARPA Order No. 292, Stanford Res. Inst., Menlo Park, Calif., 1967.

VESIAC 17,146 VU
AD 662 894

Explosion-induced radiation patterns in prestressed plates which represent two-dimensional models of explosions in the prestressed earth have been studied. Radiation patterns of the resulting plate compressional and plate shear waves were observed using dynamic photoelasticity and electrical strain gages. Although compressional and shear waves were clearly optically resolved, no azimuthal variation was seen with compressional or shear wave radiation patterns.

AHRENS, T. J., J. T. ROSENBERG, and M. H. RUDERMAN, Dynamic Properties of Rocks, Final Report, Rept. No. FGU-4816, Contract DA-49-146-XZ-277, Stanford Res. Inst., Menlo Park, Calif., 1966.

VESIAC 15,723 VU
AD 809 011L

Hugoniot equation-of-state measurements using streak camera techniques have been performed for minerals which are constituents of common crustal rocks. All these minerals, except calcite, exhibit Hugoniot elastic limits (HEL) of the order of 50 kbar; the elastic limit for calcite is about 25 kbar. At pressures above the HEL, the Hugoniots of the minerals indicate, either by cusps or by anomalously high compression followed by a marked increase in incompressibility, that one or more shock-induced transitions to high pressure polymorphic forms occur.

AHRENS, T. J., and M. H. RUDERMAN, Dynamic Properties of Rocks, Interim Final Rept., DA-49-146-XZ-277. Stanford Research Institute, Menlo Park, Calif., 1965.

VESIAC 13,121 VU

Described are investigation results of: (a) the stress relaxation of elastic-shock waves in Arkansas novaculite and Sioux and Eureka quartzite; (b) the Hugoniot of single and polycrystalline quartz in the range 280-410 kbar, polycrystalline augite and diopside to 370 kbar, and single-crystal calcite in the range 240-340 kbar; (c) development and application of a new optical lever technique for optically recording multiple shock fronts; (d) determination of release adiabats from both the elastic and the deformational shock states (72 - 80 kbar and 122 - 154 kbar, respectively) in Arkansas novaculite with this technique.

AIR FORCE OFFICE OF SCIENTIFIC RESEARCH (STAFF), Recommendations on Research in Seismology for the VELA-UNIFORM Program of the Advanced Research Projects Agency, Agency Document, Air Force Office of Scientific Research, Wash., D. C., 1963.

VESIAC 6161 VU
AD 418 036

The Advisory Committee for Geophysics of the AFOSR has undertaken to review the present state of research in support of the VELA-UNIFORM Program and to make recommendations for future research. The present programs have been guided by the 1959 recommendations of the Berkner Panel. The accompanying report summarizes the committee's opinions on progress since 1959 and its recommendations for research, both basic and applied, needed to further the objectives of VELA-UNIFORM. Areas on which recommendation have been made are: Identification techniques, data processing, arrays, deep-hole and ocean-bottom detection, magnitude/energy scale, noise studies, seismicity, source mechanisms, explosions and earthquakes, and other subjects.

AIR FORCE OFFICE OF SCIENTIFIC RESEARCH (STAFF), Research in Seismology, VELA UNIFORM Program, Bibliography, Report No. AFOSR 65-2667, Contract: Agency Document, Air Force Office of Sci. Res., Washington, D. C., 1965.

VESIAC 19,028 VU
AD 632 453

This report is a bibliography of contracts for the Vela Uniform Program - Research in Seismology.

AIR FORCE OFFICE OF SCIENTIFIC RESEARCH (STAFF), VELA UNIFORM Program - Research in Seismology, Rept. No. AFOSR 65-2667, Contract, Agency Document, Air Force Office of Scientific Research, Washington, D. C., 1965.

VESIAC 15,901 VU
AD 632 453

This report presents a short statement of the accomplishments, and a list of all reports and journal articles generated under AFOSR - sponsored contracts for the VELA UNIFORM Program from 1961 to 1965.

AIR FORCE TECHNICAL APPLICATIONS CENTER (STAFF), Long Range Seismic Measurements, Project 8.4, SHOAL Event, Contract No. Proj. 8.4, Air Force Technical Applications Center, Wash., D. C., 1963.

VESIAC 6511 VU

This is a VELA-UNIFORM report on the arrangement of temporary seismographic stations planned for long range seismic measurements of the SHOAL Event detonations in Nevada. There is a map showing arrangement of stations in the U.S. and Southern Canada, plus a list of six temporary arrays in operation in other countries. A table is included which gives the relationships of the stations to the epicenter in terms of: distance in degrees, distance in kilometers; azimuth; back azimuth; and site coordinates.

AIR FORCE TECHNICAL APPLICATIONS CENTER (STAFF), Tonto Forest P-Wave Study, Contr. No. VT/070, AF 33(657)-7747, Air Force Technical Applications Center, Wash., D. C., 1964.

VESIAC 8156 VU

For four months in spring 1964 a study of spatial variations in P waves was made. Its primary objective was to investigate the coherence and other measures of wave form similarity of teleseismic P waves over a region covering several hundred kilometers at various epicentral distances, and to determine other seismological factors which enter into the design of large arrays. This bulletin describes briefly the equipment setup of the nine mobile stations in the area, and lists the items needed. Illustrations show the layout of the stations and the setup of the telemetry equipment. In progress are attempts to investigate the way in which the change in P waves over long distances limited large arrays.

AKI, K., Seismological Evidences for the Existence of Soft Thin Layers in the Upper-Mantle Under Japan, Contract Order No. ARPA 292, Mass. Inst. of Tech., Cambridge, Mass., 1967.

VESIAC 16,516 VU

In studies of the crust-mantle structure under Japan, it is difficult to explain the phase velocities of Love and Rayleigh waves by any single model with a weakly heterogeneous isotropic upper mantle. The significance of the problem is confirmed by the data on S waves from local mantle earthquakes. In order to expla n these observations, a laminated mantle model is proposed, in which soft horizontal layers are interleaved in hard material. The data supports a model having 2% soft material with shear velocities as low as 1.1 km/sec.

ALAM, A., Large-Array Signal and Noise Analysis, Special Rept. No. 24, Analysis of Summer Long-Period Noise, Contract VT 6707, AF 33(657)-16678, Texas Inst., Inc., Dallas, Texas, 1968.

VESIAC 19,103 VU
AD 843 108

The summer noise samples are very similar to the quiet winter noise samples. The following additional conclusions about long-period noise resulted from this study. Nonseismic noise below 0.05 Hz is not strongly correlated with a microbarograph at the same location (for both vertical and horizontal components). This lack of coherence appears to rule out a simple cause-and-effect relationship due to buoyancy.

ALEXANDER, S. S., Crustal Structure in the Western United States from Multi-Mode Surface Wave Dispersion, Part I of Surface Wave Propagation in the Western United States, Thesis, AF-AFOSR-25-63, California Institute of Technology, Pasadena, Calif., 1963.

VESIAC 13,100-A VU

Multi-mode group velocity dispersion of both Rayleigh and Love waves was measured for a number of paths in the Western United States by means of a technique developed for separating the modes. Results for each region studied are interpreted in terms of a crustal structure which produces simultaneous agreement with all the modes observed, as well as available body wave data. Certain diagnostic features of group velocity dispersion curves were noted and used to advantage in this study.

The analysis techniques developed have rather broad geophysical applications, for example in studies of source properties, interference phenomena, and noise properties.

ALEXANDER, S. S., The Effects of the Continental Margin in Southern California on Rayleigh Wave Propagation, Part II of Surface Wave Propagation in the Western United States, Thesis, AF-AFOSR-25-63, California Institute of Technology, Pasadena, Calif., 1963.

VESIAC 13,100-B VU

The effects of the transition zone at the continental margin of Southern California on Rayleigh wave propagation have been investigated. Among the anomalous effects discovered are a minimum in phase velocity between 20 and 35 seconds period, different phase velocities on reversed paths across the same array, and systematic lateral refraction at the continental boundary. These anomalous effects can be attributed largely to the slope and curvature of the Mohorovicic Discontinuity across this region. An ultrasonic model was constructed to aid in interpreting these results.

Interpretation of the dispersion for periods below 20 seconds indicates that the crust thickens toward the continent with a slope of about 5° attaining a thickness of approximately 35 km under Southern California.

ALEXANDER, S. S., Long-Period Seismic Methods for Identifying Small, Underground Nuclear Explosions, Final Rept., 1 April 68 to 31 May 1969, Contract AF-AFOSR 68-1576, Penn. State Univ., University Park, Pa., 1970.

VESIAC 20,087 VU

The purpose of this grant was to investigate those aspects of long-period seismic wave excitation which show promise of being diagnostic in distinguishing small explosions from earthquakes. Central to this study is the development of analysis methods to test experimentally diagnostic criteria suggested by theory and to assess the practical usefulness of these criteria.

This report describes in condensed form methods for: (a) detecting and separating Love and Rayleigh waves for small events;

(b) estimating spectra of weak surface wave signals; (c) combining Love and Rayleigh waves for improved surface wave magnitude estimates; (d) remotely determining crustal structure in seismic source regions; (e) determining site structure from ellipticity dispersion; (f) determining relative locations of events using P-waves and surface waves; and (g) numerical computations implementing these techniques.

ALEXANDER, S. S., Methods of Mode Separation of Seismic Surface Waves, Contract AF 49(638)-1337, Calif. Inst. of Tech., Pasadena, Calif., 1964.

VESIAC 10,192 VU

Two methods for delineating surface wave modes have been developed. One is based primarily on the definition of group velocity. The other utilizes the fact that individual modes are sufficiently separate over most of the group velocity-period plane that a seismogram for each mode can be obtained. These techniques are not restricted to surface wave analysis and may be applied to a variety of other geophysical problems involving analysis of complicated time series.

Computer programs were written to implement these methods so that their application is now routine.

ALEXANDER, S. S., Surface Wave Propagation in the Western United States, Thesis, AF-AFOSR-25-63, California Institute of Technology, Pasadena, Calif., 1963.

VESIAC 13,100 VU

In Part I of this work, multi-mode group velocity dispersion of both Rayleigh and Love waves was measured for a number of paths in the Western United States by means of a technique developed for separating the modes. In Part II, the effects of the transition zone at the continental margin of Southern California on Rayleigh wave propagation was investigated.

ALEXANDER, S. S., D. B. RABENSTINE, Detection of Surface Waves from Small Events at Teleseismic Distances, SDL Scientific Report No. 175, Project VT/6702, Contract AF 33(657)-15919, Teledyne Industries, Inc., Earth Sciences Div., 1967.

VESIAC 15,725 VU
AD 808 503

A matched filter approach for distinguishing weak teleseismic surface wave signals from background noise is presented. The method discriminates against events not located in a particular source region of interest and provides estimates of magnitude and radiation pattern, when a number of recording stations are available. Test cases and typical results for different source regions are discussed.

ALEXANDER, S. S., D. B. RABENSTINE, Rayleigh Wave Signal to Noise Enhancement for a Small Teleseism Using LASA, LRSM, and Observatory Stations, Contract VT/6702, F 33657-67C-1313, Teledyne Indust., Inc., Earth Sci. Div., Alexandria, Virginia, 1967.

VESIAC 16,747 VU

Both single channel and array signal enhancement techniques have been applied to Rayleigh waves from a small Greenland Sea earthquake recorded at LASA and 13 LRSM or Observatory stations. The effects of such array parameters as number of sensors, sensor spacing, and aperture on signal enhancement are evaluated for this event.

ALLEGRE, C., P. MECHLER, and Y. ROCARD, "Some Geological Problems Considered in Seismology," Bull. of Geological Soc. of France, Series 7, No. 4, pp. 877-883 1962, (Translated from French), Contract SD-78.

VESIAC 7587 VU

After presenting the principle of a new portable seismograph, we have described a certain number of problems considered with the use of this technique: microseismic disturbance and development of directional diagrams of the seismic sensitivity. The interpretation of these determinations permitted us to propose a model for the deep structure of Provence.

AL'PIN, L. M., "Nonsymmetrical (Angular) Probing," Prikladnaia Geofizika, No. 14, pp. 65-96, 1956, (Translated from Russian), Contract DA 49-083 OSA-3137.

VESIAC 14,327 VU

This report is concerned with the different methods of non-symmetrical probing including: (a) electrical probing; (b) nonsymmetrical (angular) arrangement; a plan for its application to probing; and (c) the elimination of the influence of electrode B from the measuring process, and in the process of reducing the data obtained from measurements.

ALSOP, L. E., Research Directed Toward the Use of Long and Intermediate Period Seismic Waves for the Identification of Seismic Sources, Final Rept., Contract AF 19(604)-7376, Lamont Geol. Observ., Palisades, New York, 1964.

VESIAC 8756 VU
AD 607 946

A detailed account of the research accomplished as per the Statement of Work of this contract is given. Included are: a) a study of the radiation patterns of surface waves from underground nuclear explosions and small magnitude earthquakes; certain conclusions about explosions in tuff, alluvium, and granite were reached; b) a study of the relative excitation of surface waves by earthquakes and underground explosions; c) an almost complete summary of Rayleigh wave phase and group velocities for various regions of the world; d) a program of epicenter relocation carried out for various regions; e) successful utilization of displacement transducers with L-P seismometers, thereby improving L-P response.

ALSOP, L. E., Use of Optical Masers as Transducers for Pendulum and Strain Seismographs, Final Rept. Contract AF-AFOSR 283-63, Lamont Geological Obs., Columbia Univ., Palisades, New York, 1965.

VESIAC 13,343 VU
AD 475 820

During the period of this grant, two one-meter infrared optical masers were operated in a manner such that horizontal strains would be detected. The first results have been encouraging and suggest that optical maser strain gauges will be able to compete with the much longer conventional strain gauges. An optical maser transducer for a seismograph has been built but tests have been delayed pending the completion of a temperature-control system. A special short-period seismograph to be used with this transducer was constructed. This work on optical masers stimulated the use of optical masers for optical recording and interferometric calibration by other workers at Lamont.

ALSOP, L. E., J. T. KUO, Semi-Diurnal Earth Tidal Components for Various Earth Models, Rept. No. AFCRL 65-259, Contract AF 19(604)-7376, Lamont Geological Observatory, Palisades, New York, 1965.

VESIAC 10,776 VU
AD 620 646

This study of the elastic deformation of the earth due to tidal-generating potentials evaluates the possible cause for the discrepancy between the accumulated observational data of earth tides for the principal semi-diurnal tidal constituent, M_2, and the theoretical values. The characteristic numbers, h, k, and 1 of the earth are calculated for earth models consisting of velocities due to Jeffreys or Gutenberg with Bullen A or Bullen B density distribution. Used was a modification of an earlier program for calculating the free periods of the earth. The theoretical gravimetric factors G are compared with the observed gravimetric factors of the semi-diurnal tidal constituent, M_2.

ALSUP, S. A., Preliminary Study of Acceleration Levels at LRSM Sites in the United States, Contr. No. VT/074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1963.

VESIAC 7732 VU

Recent widespread interest in seismological techniques has led to the development of sensitive and well calibrated instrumentation which make the study of very small ground motions feasible. A preliminary study of the data from 38 stations of the Long Range Seismic Measurements (LRSM) Program in the period range 0.3-1.4 seconds and 10-60 seconds shows that there are many locations in the United States with long term average peak accelerations of 10^{-7}g and less. Equivalent ground motions in the vicinity of 1 cps at over 100 LRSM stations show a range of peak accelerations from 2×10^{-7}g to about 9×10^{-9}g. Locations with these accelerations can be found only with careful site selection techniques.

ALSUP, S. A. and J. L. WILSON, Ground Disturbances from Heavy Vehicles and Well-Drilling Activities, Contr. No. VT/1124, AF 33(657)-12373, Geotechnical Corp., Garland, Texas, 1964.

VESIAC 8252 VU

Seismograms of ground disturbance from moving vehicles show correlation of ground acceleration with vehicle speed, distance from source, and near surface geology. Variation in well-drilling activity also results in acceleration changes. Computed values of ground acceleration are shown for combined vehicle weights to 80 tons, vehicle speed to 40 mph, and ground motion frequency from 2 to 6 cps.

ALTERMANN, Z. and P. KORNFELD, Propagation of an SH-Torque Pulse in a Sphere, Contract No. AF 61(052)-509, Weizmann Inst. of Sci., Rehovot, Israel, 1964.

VESIAC 8415
AD 444 671

An exact solution is obtained for the displacement of the surface of a uniform solid sphere of radius a due to an impulsive SH-torque-pulse from a point source situated at a distance b from the center. The duration of the source was varied from 0.05 a/c to 0.5 a/c keeping the time variation of the torque such that the surface-displacement stays finite when the time tends to infinity. c is the shear-wave velocity. Theoretical seismograms have been computed at several distances from a surface-source and from buried sources at b = 7a/8, a/2.0.3a, and 0. Arrival times of reflected pulses coincide with times of arrival of reflected rays, where the latter are obtained according to geometrical optics. The solution for buried sources reveals diffracted pulses.

ANDERS, S., Pn Time-Term Survey, Norway-Scotland 1967, Sci. Final Rept., Rept. No. AFOSR 68-1424, Contract AF 61(052)-859, Univ. of Bergen, Bergen, Norway, 1968.

VESIAC 19,591 VU
AD 676 679

Shot charges ranging from 135 kg to 1360 kg were used in this seismic Pn refraction survey between the west coast of Norway, Shetland, and the Scottish mainland in 1967. The apparent velocity showed signs of increasing with distance and therefore the time-terms have been calculated from equations of the form

$$t_{ij} = a_i + b_j + \Delta_{ij}/V_o - V_1\Delta_{ij}^{\ 2}/V_o^{\ 2}$$

The velocity parameters found are as follows:

$$V_o = 8.12 \pm 0.16 \text{ km/sec;} \quad V_1 = 0.00011 \pm 0.00014 \text{ sec}^{-1}$$

The calculated Pn time terms and their 95% confidence limits are given in tabular form and they are also shown graphically along some selected profiles.

ANDERSON, D. C., T. V. EICHLER, Computerized Analytical Solution for Strong Shock Propagation, Final Report, Rept. No. DASA 1867, Contract DA-49-146-XZ-197, IIT Research Inst., Chicago, Ill., 1966.

VESIAC 15,909 VU
AD 810 409L

An analytical solution for prediction of shock propagation and free field phenomena associated with the hydrodynamic response of an infinite medium to a point source energy release is described and has been programmed for a high-speed digital computer.

The theoretical treatment derives from the waste heat concept and analytical techniques of Porzel, a solution to the point source energy release problem. This study includes a contact discontinuity within the disturbed medium. The results are derived as a function of the equation of state of the medium.

ANDERSON, D. L., The Earth's Mantle, Chapter III, Latest Information from Seismic Observations, Contract AF 49(638)-1337, California Inst. of Tech., Pasadena, Calif., 1965.

VESIAC 13,845 VU

New material is presented on regional variations in the mantle, upper mantle discontinuities, upper mantle discontinuities with phase changes, the deep mantle, the anelasticity of the earth, the viscosity of the earth, and other subjects as derived from observed surface waves, free oscillations, and body waves.

ANDERSON, D. L., Recent Evidence Concerning the Structure of the Upper Mantle from the Dispersion of Long-Period Surface Waves, VESIAC Rept. No. 4410-75-X, Univ. of Michigan, Inst. of Sci. & Tech., Ann Arbor, Mich., 1964.

VESIAC 8217 C VU

The author shows that surface waves, properly used, are surprisingly sensitive to details of mantle structure. When these are used in conjunction with body-wave travel-time and amplitude data, it is possible to reduce considerably the ambiguity that is present if the methods are used independently. The author presents a number of criteria that must be satisfied for an interpretation of the outermost 800 km of earth by means of surface waves.

ANDERSON, D. L., Research in Seismic Phenomena Connected with Earthquakes and Explosions, Annual Rept., 31 October 1967 to 1 November 1968, Contract AF 49(638)-1337, Calif. Inst. of Tech., Pasadena, Calif., 1968.

VESIAC 19,401 VU
AD 684 169

The structure of the crust and upper mantle in the Western United States has been intensively studied by refraction and reflection techniques. Strong lateral variations have been found which correlate well with gravity, heat flow, P-delay, and other geophysical data. Methods have been developed to handle lateral variations both for body wave and surface wave studies. Near vertical reflections and precursors to the phase P'P' have been used to study discontinuities in the upper mantle. There are at least 6 reflectors or discontinuities in the upper mantle below 100 km. Most of the lateral changes in the upper mantle occur in the vicinity of the low-velocity zone.

A method has been developed for analyzing high pressure shock wave data in order to make direct comparisons with seismic data. The lower mantle is clearly enriched in iron compared to the upper mantle.

The low-velocity zone has been determined to be caused by partial melting. One or two per cent melt is adequate to explain the low-velocities and high attenuation. Compressional wave spectral data have been used to verify the highly attenuating nature of the low-velocity zone. The S/P amplitude method has been shown to be a powerful diagnostic of the state of the upper mantle.

ANDERSON, D. L., The Viscosity of the Earth, Contract AF 49(638)-1337, Calif. Inst. of Tech., Seismological Lab., Pasadena, Calif., 1965.

VESIAC 12,570 VU

Seismic methods are now being used to determine how much the earth departs from a perfectly elastic body. The anelasticity, or Q, varies by several orders of magnitude throughout the mantle, the main feature being an extremely dissipative zone in the upper mantle, above 400 km. A tentative empirical relationship is established between the seismic anelasticity and viscosity, and viscosities are estimated in regions of the earth inaccessible to direct measurement. The presence of a low viscosity zone in the upper mantle reconciles viscosities calculated from the shape of the earth's shape and from post-glacial uplift. The mismatch of the deformational characteristics with changing rotation rate may explain deep focus earthquakes.

ANDERSON, D. L., H. KANAMORI, Shock Wave Equations of State for Rocks and Minerals, Contract AF 49(638)-1337, California Inst. of Tech., Pasadena, Calif., 1968.

VESIAC 17,981 VU

Murnaghan, Birch-Murnaghan and linear U_s - U_p equations of state are fit to shock wave data for 9 rocks and 10 minerals. If a phase change occurs parameters of the high pressure phase are found from both the raw Hugoniot and an estimated metastable Hugoniot. The zero-pressure densities of the high-pressure phases are estimated from an empirical relationship between the density and the zero-pressure slope of the Hugoniot. Most of the materials collapsed to a denser phase when shocked to sufficiently high pressure.

ANDERSON, D. L., H. KANAMORI, Shock Wave Equations of State for Rocks and Minerals, Sci. Rept., Contract AF 49(638)-1337, Calif. Inst. of Tech., Pasadena, Calif., 1968.

VESIAC 19,301 E VU

Murnaghan, Birch-Murnaghan and linear U_s - U_p equations of state are fit to shock wave data for 9 rocks and 10 minerals. If a phase change occurs, parameters of the high-pressure phase are found from both the raw Hugoniot and an estimated metastable Hugoniot. Since the zero-pressure density of the high pressure phase is unknown, the equation-of-state parameters are found for a range of ρ_o. The zero-pressure densities of the high-pressure phases are estimated from an empirical relationship between the density and the zero-pressure slope of the Hugoniot. The parameter (dK/dP), which is related to the Grüneisen ratio, is found to decrease across phase changes and upon iron substitution.

Most of the materials collapsed to a denser phase when shocked to sufficiently high pressure. These polymorphic transitions involve a considerable reduction in volume, ranging from 38 to 60% for feldspar and quartz rich rocks such as albitite, anorthosite and granite, to 20% for such basic rocks as diabase and dunite to about 12% for some dense, already closely packed minerals such as spinel, hematite, and magnetite.

ANDERSON, O. L., Two Methods for Estimating Compression and Sound Velocity at Very High Pressures, Agency Document, Lamont Geol. Observ., Columbia Univ., Palisades, N. Y., 1968.

VESIAC 12,574 VU

Presented in this report are two functions suitable for representing volume dependence upon pressure (compression curves) and the evaluation of the parameters in these functions from acoustic data taken at low pressures but with high precision. The parameters are the bulk modulus and its higher derivatives. These new results also apply to older work on the equation of state, in particular Birch's equation of state. The features and advantages of the various equations of state are not discussed: rather, acoustic data is used to evaluate two particular compression equations. It is stated that isothermal expressions are needed, and also adiabatic expressions are needed.

ANDERSON, O. L., On the Use of Ultrasonic and Shock-Wave Data to Estimate Compressions at Extremely High Pressures, Contract AF 49(638)-1355, Lamont Geol. Observ., Columbia Univ., Palisades, New York, 1967.

VESIAC 16,518 VU

It is proposed that both the shock-wave data and the acoustically determined parameters for equations of state be used together to construct an equation of state valid beyond the range of shock-wave measurements. In the past few years, these two techniques have been used to cross check each other in the establishment of two-parameter equations of state. A three-parameter equation of state, such as proposed by Keane, is recommended. Two of these parameters are given by acoustic measurements, and the third is taken from the shock-wave data.

ANDERSON, O. L., and R. C. LIEBERMANN, Sound Velocities in Rocks and Minerals, VESIAC State-of-the-Art Report, Rept. No. 7885-4-X, Contract SD-78, DA-49-083 OSA-3137, Univ. of Mich., Inst. of Sci. & Tech., Ann Arbor, Mich., 1966.

VESIAC 15,312 VU

This report summarizes experiments and data on sound velocities in rocks and minerals and projects lines of research. It discusses the three techniques employed: (1) resonance; (2) pulse-transmission (time-of-flight); (3) ultrasonic-interferometric.

Techniques, direct and indirect, are described. The most important is resonance of small spheres. Methods of estimating elastic constants at high pressure and temperature are indicated.

Data on sound velocities in rocks and minerals are tabulated. Lack of systematic coverage and quality of these data is discussed.

A method of estimating unmeasured properties in a class of rocks, using data reported for that class, is reviewed. Techniques of estimating isotropic sound velocities from single-crystal elastic-constant data are reviewed.

ANDERSON, O. L., E. SCHREIBER, Measurement of P and S Sound Velocities Under Pressure on Laboratory Models of the Earth's Mantle, Final Rept., Contract AF 49(638)-1355, Lamont Geol. Observ., Columbia Univ., Palisades, New York, 1965.

VESIAC 13,918 VU
AD 478 109

The techniques of ultrasonic interferometry were used to measure the isotropic sound velocities and their derivatives for polycrystalline specimens of aluminum oxide and magnesium oxide.

From data, the critical temperature gradient for velocities was evaluated and the velocity behavior of these materials as a function of temperature and depth in the mantle are discussed. It was found that they exhibit a shear velocity minimum and a less pronounced longitudinal velocity minimum under conditions likely to exist in the upper mantle.

ANDERSON, O. L., E. SCHREIBER, Measurement of P and S Sound Velocities under Pressure on Laboratory Models of the Earth's Mantle, Contract AF 49(638)-1355, Lamont Geol. Observ., Columbia Univ., Palisades, New York, 1967.

VESIAC 16,636 VU

Abstracts of papers either published or submitted for publication during the reporting period are presented in this report. In addition, the results of temperature experiments upon a special single crystal are reported.

ANDREW, D. B., Long-Period Seismograph Development, Special Rept. No. 1, Contract VT/6706, AF 33(657)-16406, Teledyne Indust., Inc., Geotech Div., Garland, Texas, 1969.

VESIAC 19,278 VU

This report is submitted to detail the effort necessary to provide a triaxial seismograph shallow-hole facility at Murphy Dome, Alaska.

ANDREW, D. B., B. M. KIRKPATRICK, Long-Period Seismograph Development, Quarterly Report No. 4, 1 January Through 31 March 1967, Contract VT/6706, AF 33(657)-16406, Teledyne Indust., Inc., Geotech Division, Garland, Texas, 1967.

VESIAC 16,902 VU

Development of the long-period triaxial seismometer and laboratory testing of its characteristics is essentially complete. Manufacturing changes in the mass-lock and period-adjust mechanisms are required before they can be assembled on the seismometer for laboratory and field tests of the instrument. Shake-table frequency response, the effect of temperature changes on mass position, and the effect of instrument tilt on the mass position and free period are reported.

ANDREW, D. B., and B. M. KIRKPATRICK, Long-Period Triaxial Seismograph Development, Quarterly Rept. No. 8, Rept. No. TR 68-31, Contract VT/6706, AF 33(657)-16406, Teledyne Indust., Inc., Geotech Div., Garland, Texas, 1968.

VESIAC 19,047 VU
AD 841 041

Field operation of the long-period triaxial seismograph at the Uinta Basin Seismological Observatory continued through April and May when the seismometer was removed for installation in another borehole facility. Test results that show the stability of operational parameters are given. Operational improvement over the advanced long-period system in the presence of wind and barometric pressure noise is illustrated.

ANG, D. D., and L. KNOPOFF, Diffraction of Scalar Elastic Waves by a Finite Crack, GRANT AF-AFOSR-26-63, California Inst. of Tech., Pasadena, Calif., 1964.

VESIAC 12,014 VU

In an earlier paper the authors presented the long-wave length solution to the problem of the diffraction of scalar waves by a two-dimensional strip. The boundary conditions were such that the strip was clamped. Here, they consider the more practical problem of the diffraction by a strip with weak boundary conditions, for which the normal stresses vanish.

ANSORGE, J., Seismic Model Studies, Part 2, Experimental Studies of Two-Dimensional Wave Propagation in the Elastic Half-Space with and without Surface Layer, (Translated from German), Publication of the County Seis. Service of Baden-Wurttemberg, Stuttgart, Germany, 1964, Contract SD-78.

VESIAC 8977 VU

The present study is the second part of the series of seismic model investigations begun in 1962 by the County Seismological Service of Baden-Wurttemberg. On the basis of the seismic model formulated and described by R. Schick in the first part, the aim was to develop a measuring method for the investigation of inhomogeneous wave fronts and their application to classical seismic problems.

The fundamentals and results of the investigations have already been published in summary form in the journal Geophysical Prospecting, 1963. In the present expanded contribution, the problems are each preceded by a theoretical treatment of two-dimensional wave propagation in a uniform manner and are then compared with test results.

APTIKAEV, F. F., "Parameters of Seismic Oscillations Generated by an Explosion," Akad. Nauk. Academy of Sci., Vol. 32, pp. 49-62, 1964, (Translated from Russian), Contract SD-78.

VESIAC 10,217 VU

Determination is made of the empirical relations between the quantities which represent the seismic effect of an explosion (focal radius, seismic energy of the source, amplitude, oscillation period, etc.). In particular, it is shown that in a near zone the magnitude of the absorption decrement depends on the stress of the medium.

On the basis of the obtained relations between the parameters of the seismic oscillations, we draw certain conclusions concerning the relationship between the magnitude and energy of the source, and a comparison is made between the seismic effect of chemical and nuclear explosions.

ARCHAMBEAU, C. B., Elastodynamic Source Theory: Part 1. General Theory (THESIS), Contract AF 49(638)-1337, Calif. Inst. of Tech., Pasadena, Calif., 1967.

VESIAC 15,541 VU

This study exceeds the dynamical theory of tectonic sources to provide a more complete description of earthquakes in terms of these basic parameters of rupture, including pre-stress, while at the same time making no assumptions concerning the nature of equivalent forces at the source or of their time dependence. The theory predicts the spatial and temporal form of the radiation field in terms of the initial pre-stress field and the basic rupture parameters and follows from the recognition that such a phenomenon is described analytically as an initial value problem. A complete development of the dynamical relation theory for tectonic sources, including considerations of total energy release and the final equilibrium field, was made.

ARCHAMBEAU, C. B., A Theoretical Study of Elastodynamic Radiation Fields from Stress Relaxation Sources, Final Sci. Rept., 4 January 1968 to 4 January 1969, Rept. No. AFCRL-69-0161, Contract F19628-69C-0160, Calif. Inst. of Tech., Pasadena, Calif., 1969.

VESIAC 19,920 VU
AD 687 754

This report summarizes the work accomplished and the present status of investigations of stress wave radiation from earthquakes and explosions in prestressed media. Specifically we have treated the radiation from an explosion in a prestressed plate as a superposition of stress relaxation and shock wave conversion, using an equivalent source for the latter. The results of this theoretical work are obtainable in the form of a computer program which can be used to predict the radiation field. A similar theoretical approach has been devised to explain the radiation from underground explosions in tectonically stressed regions. A paper on this latter work is in preparation. Application of this theory to the underground nuclear explosion Bilby has been completed and submitted for publication. Additional generalizations of previous theoretical work on tectonic (earthquake) sources were carried on, in part supported by this contract, and a paper is in preparation.

ARCHAMBEAU, C. B. and S. ALEXANDER, The Nature of Short-Period Microseism Noise and Its Elimination at Depth, Contract No. VT/1129, AF 33(600)-42890, United ElectroDynamics, Inc., Pasadena, California, 1963.

VESIAC 7576 VU

An analysis of vertical component microseism noise with depth in the period range 0.2 to 4 seconds indicates that the noise is coherent and is associated with the first several Rayleigh wave modes. Maxima in the noise power spectrum occur at periods of 0.3 and 3.5 seconds. Theoretical ratios of displacement at depth to surface displacement for the first three Rayleigh modes were computed. Comparison of the observed and theoretical ratios indicates that for periods under one second, the noise is predominantly higher mode. Although experimental limitations hamper modal identification around three seconds and above, the longer period noise appears to be primarily fundamental mode.

ARCHAMBEAU, C. B., and E. A. FLINN, Perturbation Methods for the Inversion of Body Wave Travel-Time Data, Contract VT/6702, AF 33(657)-15919, and AF 49(638)-1337, Calif. Inst. of Tech., Pasadena, Calif., 1967.

VESIAC 15,728 VU

A perturbation method is described in which an initial velocity distribution, which may be chosen to be in agreement with surface wave dispersion data over the region in question, is perturbed iteratively until the theoretical travel time function is in agreement, in the least-squares sense, with the observed data. The method does not require any estimate of the curve slope or multiplicity, nor does it require a particularly dense and complete data coverage over the entire distance range. Several phases can be used simultaneously.

ARCHAMBEAU, C. B., E. A. FLINN, Perturbation Theory for the Inversion of Body Wave Travel-Time Data, Rept. No. SDL Rept. 142, Contract VT/6702, AF 33(657)-15919, Teledyne Industries, Inc., UED, Alexandria, Va., 1966.

VESIAC 14,184 VU
AD 630 699

A perturbation method is described in which an initial velocity distribution, which may be chosen to be in agreement with surface-wave dispersion data over a region in question, is perturbed iteratively until the theoretical travel-time function is in agreement, in the least-squares sense, with the observed data. The method does not require any estimate of the curve slope or multiplicity, nor does it require a dense and complete data coverage over the entire distance range. Several phases can be used simultaneously. Equations are given for the initial velocity distribution, and the variations at each step in the iteration process are computed.

ARCHAMBEAU, C. B., C. SAMMIS, Seismic Radiation from Explosions in Prestressed Media and the Measurement of Tectonic Stress in the Earth, Sci. Rept., Contract F44620-69C-0067, Calif. Inst. of Tech., Pasadena, Calif., 1969.

VESIAC 19,303 VU

Theoretical predictions of the radiation field from explosions in a prestressed medium may be made on the basis of a dynamical theory of stress relaxation in the vicinity of the shock induced fracture zone created by an explosion. In this case, the field consists of the normal compressional wave field resulting from the conversion of the shock wave to an elastic wave plus an anomalous part due to the release of strain energy. In this study, we consider the nature of the radiation field to be expected from such a source in an inhomogeneous earth and determine the stress field required to explain the observations from a large underground explosion.

ARKHANGEL'SKAYA, V. M., "The Determination of the Direction of the Earthquake Epicenter by Using Recordings of the Surface Waves for Distant Earthquakes," Trudy Geofiz. Inst., Akad. Nauk, SSSR, No. 30, pp. 82-88, Undated, (Translated from Russian), Contract DA 49-083 OSA-3137.

VESIAC 17,453 VU

A method is presented for a unique determination of the direction of the epicenter by using recordings of the surface waves for distant earthquakes having a shallow source. Methods are introduced for determining the azimuth. The accuracy in determining the azimuth by examining the surface waves is $\pm 2^{\circ}$ and therefore has practical application in seismic investigations.

ARROYO, A. L., Background Noise on the SSS Standard Instruments, Contract AF 61(052)-657, Instituto Geografico Y Catastral, Madrid, Spain, 1964.

VESIAC 10,286 VU
AD 628 023

A minimum of the amplitude in the neighborhood of 2 cps, already observed at many sites of the USA, is also shown for Toledo and Malaga; whereas the maximum of the spectrum around 4 - 8 sec, established by Brune and Oliver and considered by them as a major result of observational seismology is not clearly defined. Such ratio is used for computing the thickness of the sedimentary layer at the observatories.

Observation shows the existence of a predominant period of microseisms at the two places considered. The data include periods greater than 0.4 sec only, since the instruments are not sensitive enough for recording shorter period microseisms; but they show a clear distinction between the period distribution curves of Toledo and Malaga, which is explained in terms of difference in geologic structure.

A very near origin (inside the vault, perhaps in the seismometer) is suggested for pulses observed on the three LP components. SP disturbances, on the other hand, are seen to be produced partly by traffic along nearby road.

ARROYO, A. L., Differences in Pa and Sa Continental Travel Times, Contract SD-78, Univ. of Mich., I. S. T., Ann Arbor, Mich., 1966.

VESIAC 13,999 i VU

A comparison is made between the wave velocities of Pa and Sa through lowlands (Northern Europe and Asia) and through high mountain regions (the Alps and the Himalayan range). The variations of continental Pa and Sa velocities correspond to differences in upper mantle structure.

ARROYO, A. L., Mantle Surface Waves to Toledo and Malaga, First Results, Sci. Rept. No. 18, Contract AF 61(052)-657, Inst. Geofrafico Y Catastral, 1966.

VESIAC 16,496 VU

Techniques of spectrum analysis are applied to Toledo and Malaga long period records of three selected earthquakes for the purpose of deducing the phase velocity and attenuation features of the corresponding paths. The necessity of correcting the surface wave data for all possible causes of error in the study of upper mantle structure of short paths is shown. Main errors, in the studied cases, are due to the interference of different waves overlapping in the record section considered.

ARROYO, A. L., Observations of Near Earthquakes by Long-Period Seismographs, Contract SD-78, Univ. of Mich., I. S. T., Ann Arbor, Mich., 1966.

VESIAC 13,999 h VU

A recent series of moderately strong earthquakes with epicenters less than 20 km from Malaga Observatory has been recorded by the Press-Ewing L-P instruments at this station. Some features of these recordings are briefly discussed and compared with similar disturbances studied in previous papers.

ARROYO, A. L., Origin and Propagation of Microseisms Recorded by the Toledo and Malaga Seismographs of the WWSSN, Contract AF 61(052)-657, Inst. Geograf. y Catastral, Madrid, Spain, 1964.

VESIAC 14,810 VU

The origin and propagation of LP microseisms recorded at Malaga and Toledo stations are investigated by means of the Jensen empty half-plane method for the determination of the approach direction and the measurement of the microseismic frequency slope for computing the distance of the energy source to the generation area. It is shown that this slope method, used by Haubrich and others, with data from power spectr m analysis of LP records, is also applicable to the direct readings over such records of the predominant period. Results, which are in accordance with other findings discussed in the report, demonstrate that Toledo and Malaga microseisms are generated by an interference mechanism in the neighborhood of the Iberian peninsula coasts.

ARROYO, A. L. and A. UDIAS, The Focal Mechanism of the Spanish Earthquake of 15 March 1964, from Body and Surface Waves, Sci. Rept. No. 26, Contract AF 61(052)-657, Instituto Geografico Y Catastral, Madrid, Spain, 1968.

VESIAC 18,330 VU
AD 671 517

Rayleigh wave spectral amplitudes and phases are compared with theoretical radiation pattern for the fault plane solution obtained from body waves; the best fitting fault plane is N 68° E, dipping 82° to the SE. The computer program FOUR2 used for Fourier analysis and data reduction is described in the Appendix.

ARTHUR D. LITTLE, CO. (STAFF), Development of a Three-Axis Long Period Seismograph, Seventh Quarterly Rept., 31 Dec. 1968 to 15 Mar. 1969, Contract F44620-67C-0107, Arthur D. Little, Co., Cambridge, Mass., 1969.

VESIAC 19,622 VU

During the test period in which approximately 100 seismic events were recorded we observed that the detection ability for surface waves of small events by the ADL system was comparable to that of the other systems.

Two ADL systems operated reliably under field conditions at the Ogdensburg mine and permitted recording teleseismic events of surface wave magnitude of less than 3 with the horizontal seismometers and of the order of 3.5 with the vertical seismometers.

For its size (4.75 in. O. D.) the ADL seismometer is probably the smallest long-period, high-performance instrument in existence.

The use of feedback made it possible to obtain a high degree of matching between the individual seismographs of the two ADL systems.

On the basis of the demonstrated performance of the horizontal seismometers we conclude that the noise level in the vertical instruments can be significantly reduced.

BACKUS, G. E., B. BLOCK, H. BRADNER, and R. D. MOORE, Low Level Earth Motion, Sci. Rept., Final Rept., Contract AF 49(638)-1388, Univ. of Calif., La Jolla, Calif., 1969

VESIAC 20,219 VU

A scheme recently proposed by the authors for constructing Earth models which fit a given finite set of gross Earth data is applied to the problem of constructing a P-velocity structure which, within experimental error, fits the observed travel times in the range $\Delta = 25^o(5^o)95^o$. Three such models are obtained, all of which fit the observed travel times with residuals less than 0.06^s, whereas 0.5^6 is the estimated standard error of the observations. The models differ mainly in the outer 700 km of the mantle.

A gross Earth datum is a single measurable number describing some property of the whole Earth, such as mass, moment of inertia, or the frequency of oscillation of some identified elastic-gravitational normal mode. We suppose that a finite set G of gross Earth data has been measured, that the measurements are inaccurate, and that the variance matrix of the errors of measurement can be estimated.

BACKUS, G. E., and F. GILBERT, Note on Produce Integrals - Part II, Contract AF 49(638)-1388, Univ. of Calif., San Diego, Calif., 1965.

VESIAC 11,827-B VU

A recent paper by J. Kane and E. R. Surynarayan discusses what amounts to Volterra's theory of the product integral solution of ordinary linear differential equations. Since Volterra's work seems not to be as widely known as it should be, the authors call attention to the fact that he has already solved, for linear ordinary differential equations of arbitrary order, the problem discussed by Kane and Surynarayan for second order equations. Equations are given and discussed. Volterra's product integral is given, which is sometimes called the matricant of the first equation given. Product integrals are defined; the theories of convergence and approximation are discussed.

BACKUS, M. M., Array Research, Rept. No. TR-3, Project, VT/4053, Contract AF 33(657)-12747, Texas Instruments, Inc., Dallas, Texas, 1965.

VESIAC 10,747 VU
AD 625 556

Discussed are these topics: a) vertical arrays for teleseismic signal extraction. Deep-well seismic data recorded at UBO in Sept.-Oct. 1964 are used to estimate the capabilities of three 3-element vertical arrays and one hypothetical 6-element vertical array: b) deconvolution and autocorrelation study. The application of deconvolution and autocorrelation techniques to three ensembles of earthquake records from the multichannel processor at CPO is being studied; c) probabilistic processing; d) study of partial arrays at CPO; e) initial processing and analysis of the long TFO noise sample; f) further analysis of TFO ambient noise.

BACKUS, M. M., G. T. BAKER, Array Research - Discussion of LASA Processing Requirements, Special Report No. 13, Contract VT/4053, AF 33(657)-12747, Texas Inst., Inc., Dallas, Texas, 1966.

VESIAC 14,065 VU
AD 480 362

This report presents a possible processing system for a LASA installation. It is assumed that each LASA installation is a part of a network of stations with the objective of world-wide monitoring of nuclear explosions and earthquakes. First, the general system concept and processing functions are presented. Second, the nature of seismic noise, seismic signal and S/N as each relates to seismic processing functions are examined and, finally, a summary of the system is presented.

BACKUS, M. M., and G. T. BAKER, Discussion of LASA Processing Requirements, Contract: VT/5053, AF 33(657)-13899, Texas Instr., Inc., Dallas, Texas, 1965.

VESIAC 13,858-Q VU
AD 648 415

This paper presents a possible processing system for a LASA installation. It is assumed that each LASA installation is a part of a network of such stations with the objective of world-wide monitoring of nuclear explosions and earthquakes. First, the general system concept and processing functions are presented. Second, the nature of seismic noise, seismic signal, and signal-to-noise ratio as they relate to seismic processing requirements are discussed. Next, details of the processing functions are examined. Finally, a summary of the system is presented.

BACKUS, M. M., and R. G. BALDWIN, Array Research, Semiannual Tech. Rept., 15 May 1965 to 15 November 1965, Contract VT/4053, AF 33(657)-12747, Texas Instr., Inc., Dallas, Texas, 1965.

VESIAC 16,652 VU
AD 480 429

This report presents a description of work accomplished on the continued development of array processing technology for nuclear surveillance and exploitation of the superior data available from arrays for analysis of distant P-waves.

BACKUS, M. M., R. G. BALDWIN, R. RODEN, and F. BINDER, et al., Array Research, Semiannual Technical Report No. 4, Contract: VT/4053, AF 33(657)-12747, Texas Instr., Inc., Dallas, Texas, 1965.

VESIAC 13,744 VU

Work during the period covered by this report has included: (a) processing of vertical array data for evaluating MCF systems and decomposing the ambient noise field into constituent modes; (b) study of the use of horizontal with vertical seismometers for signal extraction; (c) processing of CPO teleseisms in connection with crustal and wave propagation study; (d) further study of CPO partial arrays, especially in reference to seismometer inequalization; (e) study of non-directional array processing; (f) seismic signal detection studies; (g) a study of the Montana LASA detection abilities; (h) collection of data; (i) an automated mapping program.

BACKUS, M. M., J. BURG, G. BAKER and R. RODEN, Array Research, Semiannual Rept., Contr. No. VT/4053, AF 33(657)-12747, Texas Inst., Inc., Dallas, Texas, 1964.

VESIAC 8259 VU
AD 442 664

The general use of small (14 km diameter) arrays for extraction of mantle P-wave signals from ambient noise has been investigated. The usefulness and practicality of the online application of multichannel filtering based on least-mean-square-error linear processing theory were demonstrated. Section II of this report summarizes the present state-of-the-art of this type of array processing. The remainder of the report discusses new results obtained during the first six months of Project VT/4053 in these areas: 1) developments in multichannel filtering of array outputs; 2) probabilistic detection processing; 3) vertical arrays; 4) evaluation of deconvolution and autocorrelation analysis of signal waveforms from seismometer arrays.

BAILEY, J. R., R. S. SIMONS, The Relationship Between Signal Amplitudes and Surface Geology at the TFSO Extended Array, Project VT/6703, Contract AF 33(657)-16270, Teledyne Indust., Inc., Geotech Div., Garland, Texas, 1967.

VESIAC 16,632 VU

A study of 48 teleseismic P waves recorded at six LRSM sites in Arizona shows a wide variance in the relative signal amplitudes among sites, although the mean amplitude at each site correlates very well with the seismic impedance of the stratum directly supporting the seismometers. A test indicates that this variability cannot be simply ascribed to differences in source or azimuth, suggesting that the amplitudes are reacting sensitively to changes in signal frequency and/or angle of incidence.

BAKER, G. T., Computer Simulation of the Five-Channel Measured-Noise Isotropic Processor at Tonto Forest Seismological Observatory, Contr. No. VT/077, AF 33(657)-12331, Texas Inst., Inc., Dallas, Tex., 1964.

VESIAC 8136 VU

This report describes the methods and presents the results of a digital computer simulation of the 5-channel Measured-Noise Isotropic Processor (MIP) applied to the TFO array. Also, the performance was estimated of simple summation of the 31 seismometer channels. Both the MIP and the 31 performances were compared to the center seismometer of the array (Z-16). Comparisons are presented of the signal preservation and noise rejection of these three systems in the time and frequency domains. A Develocorder film analysis of the actual performance of the MIP, as implemented on the Multiple Array Processor (MAP) at TFO, yielded results of this computer simulation. The meaning of "MIP", referring to one multi-channel filter system designed for TFO, is given.

BAKER, G. T., J. A. BONNER, and R. B. RODEN, Initial Analysis of Long-Period Large-Aperture Data Recorded at the Tonto Forest Seismological Observatory in 1965, Array Research Special Rept. No. 16, Contract VT/4053, AF 33(657)-12747, Texas Instr., Inc., Dallas, Texas, 1966.

VESIAC 15,178 VU
AD 803 359

Results of preliminary analysis of long-period noise and signal data collected at the Tonto Forest Seismological Observatory (TFO) are presented. This work is the preliminary evaluation of the potential contribution of very-large-aperture long-period seismometer arrays to the nuclear blast detection and classification problem.

Data analyzed were three 40-min noise samples and three 40-min teleseismic signals (encompassing the P through R interval) collected from an array consisting of eight 3-component, 20-sec seismometers laid out in a 200-km diameter array with a 50-km minimum element spacing. Over the usable band from about 0.02 cps to 0.2 cps, the ambient noise was essentially incoherent from one element to another, using a maximum correlation lag of 47 sec.

BAKER, R. G., Applications of Source Mechanism Studies to the Identification of Nuclear Explosions, Contract No. AF 19(604)-8517, Texas Inst., Dallas, Texas, 1963.

VESIAC 6202 VU
AD 402 642

This report describes how source mechanism studies are being applied to the problem of identifying nuclear explosions, and discusses results so far obtained. Two investigations are being conducted: first, to upgrade understanding of major fault motions in seismic areas, sets of maps showing most of the published fault-plane solutions, and including solutions obtained on this project for 1960 earthquakes, are being prepared; second, two theoretical differences of earthquake-generated waves from explosion-generated waves, namely, phase amplitude ratios (P/S, SV/SH, P/SV) and P-amplitude radiation patterns, are being tested.

BAKER, W. L., The Effect of Source Depth on Rayleigh Waves, Special Rept., No. 3, Contract No. AF 19(604)-8344, Calif. Res. Corp., La Habra, Calif., 1963.

VESIAC 6111 VU
AD 415 946

The waveform of Rayleigh motion from a point compressional source in a layered model is investigated with emphasis on the variation in waveform as a function of source depth, and, to a lesser degree, of range. Solutions are obtained for the Fourier spectra of the radial and vertical components of displacement. They are evaluated numerically for the individual modes and the total motion resulting from the sum of the normal modes. Given are the quantities which can be varied in the evaluation program. Results show that the higher frequency motion increases as the source is placed deeper within the layer and that the amplitude spectra of the Rayleigh phase may be of value in focal depth studies for sources within the surface layer.

BAKER, W. L., Processing of Linear Array Data, Special Report No. 1, Contract AF 19(604)-8344, Calif. Res. Corp., La Habra, Calif., 1964.

VESIAC 14,323 VU

This report presents the results of a study on the processing of seismograms recorded by a linear array of seismometers. The seismograms used were supplied through the courtesy of Dr. H. I. S. Thirlaway, by the U. K. Atomic Energy Authority. The recordings were of two seismic events, a French explosion in the Sahara (Southern Algeria) on March 18, 1963, and a Libian earthquake with a magnitude comparable to that of the explosion. The principal objectives of the study are given. They had to do with signal-to-noise improvement and an investigation of the application of an automatic event selection system to the processed records.

BAKHSHIYAN, F. A., "A Spherical Pressure Wave in an Elasto-Plastic Medium," Inst. Mekh. Akad. Nauk Soyuza SSR Prikl Matem. i Mekh., Vol. 12, pp. 281-286, 1948, (Translated from Russian), Contract SD-78.

VESIAC 6044 VU

The propagation of an elasto-plastic spherical wave in the absence of decompression is examined in the present work. Al'tshuler studied the problem of the distribution of a spherical pressure wave in a plastic medium in a somewhat different formulation.

BALASHKO, Y. G., "On Questions Regarding the Methods of Analysis of Local Earthquakes," Trudy Geofiz. Inst., Akad. Nauk, SSSR, No. 20, pp. 75-80, Undated, (Translated from Russian), Contract DA 49-083 OSA-3137.

VESIAC 17,452 VU

Presented is a short review of the methods of analyzing local earthquakes and their classifications and the characteristics of the practical use for each of these methods.

BALDWIN, R., Hardware Requirements for LASA Central Signal Processing System, Contract: VT/5053, AF 33(657)-13899, Texas Instr., Inc., Dallas, Texas, 1965.

VESIAC 13,858-T VU
AD 648 415

In this report, the hardware requirements for a specific on-line LASA processing scheme are described. It is apparent that some of the assumptions which were made regarding filter length, and so forth, .nay not agree with the values which will be used in a final system design. However, it is believed that the information which has been presented serves to illustrate that such a system is feasible.

BALDWIN, R. and M. BACKUS, Array Research Multichannel Filter Systems for Tonto Forest Observatory, Contr. No. VT/4053, AF 33(657)-12747, Texas Inst., Inc., Dallas, Texas, 1964.

VESIAC 8854 VU

Thre^ multichannel filter systems were synthesized for use at TFO. T absolute power density level of the noise at TFO was found to be substantially quieter than either CPO to WMO at frequencies above 0.5 cps. There was a noticeable lack of peaks in the TFO spectra. The shape of the TFO auto power spectra varied considerably over a 20-minute period. Narrow-band noise records indicated a large contribution of high-velocity noise at frequencies above 0.5 cps in the total noise field. Using measured noise from unequalized seismometers, with a perfectly equalized model to design the ring MCF system, introduced an artificial set of differences between low-frequency signal and noise on which the system could capitalize.

BALDWIN, R., and M. BACKUS, Array Research Multichannel Filter Systems for Tonto Forest Observatory, Special Rept. No. 3, Project VT/4053, Contract AF 33(657)-12747, Texas Instr., Inc., Dallas, Texas, 1964.

VESIAC 8965 VU

These experiments have shown that isotropic multichannel processing is not an effective means of extracting high frequency signals from background noise. A ring MCF system was designed to use measured noise with a signal model containing random gain fluctuations between seismometers. The signal-to-noise improvements were no better than those obtained with a straight summation process. The MCF system was not particularly sensitive to random noise. If signals are to be effectively extracted from noise on a velocity basis, there must be a finite difference between the two propagation velocities irregardless of the size of the array.

BALDWIN, R., and M. M. BACKUS, Array Research-A Re-Evaluation of S/N Improvement for CPO Using Local Noise, Special Rept. No. 5, Contract AF 33(657)-12747, VT/4053 (AFTAC), Texas Instr., Inc., Dallas, Texas, 1964.

VESIAC 9611 VU

Explained is the fact that no appreciable signal-to-noise improvement for low level ambient noise at CPO arose from MCF systems designed from specific noise samples rather than from an ensemble, although significant improvement occurred for a single sample containing high-level, low-frequency noise when it was used. Experiments are planned to discover whether the spectral content of the noise sample is important in regard to whitening, and whether the spectral content of the input noise is important in the equalization problem. In testing the random noise response, wave number response, and response to unequalized signals of two noise samples, A and C, it was discovered that either the equalization problem was more severe during the recording of noise sample C.

BALDWIN, R., M. BACKUS, J. BURG and E. BRYAN, Synthesis and Off-Line Evaluation of a Multi-Channel Filter System Designed From a Theoretical Model of Signal and Noise for the Enhancement of Mantle P Waves, Contr. No. VT/077, AF 33(657)-12331, Texas Inst., Inc., Dallas, Texas, 1963.

VESIAC 7734 VU

A multi-channel filter system was synthesized for Cumberland Plateau Seism. Observ. (CPO) on the basis of a theoretical model of signal and noise. An off-line evaluation was performed by processing actual recorded data from CPO through a computer simulation of the on-line Multiple Array Processor (MAP). The design goal of the Theoretical Isotropic Processor (TIP) was to provide a single output trace in which all mantle P waves (velocity greater than 8.1 km/sec) were preserved over a wide frequency range, and in which all low velocity (2.5 km/sec to 3.5 km/sec) energy was attenuated. The general performance of the TIP appears to have been satisfactory, relative to its design goal.

BALDWIN, R., J. BURG, M. BACKUS and E. BRYAN, Synthesis and Evaluation of a Nineteen-Channel Filter System for the Extraction of Teleseismic P-Waves from Ambient Seismic Noise at Cumberland Plateau Seismological Observatory, Contr. No. VT/077, AF 33(657)-12331, Texas Inst., Inc., Dallas, Texas, 1964.

VESIAC 8120 VU
AD 441 342

This report describes the design parameters and computer evaluation of a Measured Noise Isotropic Filter System used at Cumberland Plateau Seismological Observatory (CPO) in September and October 1963. The system was synthesized from an ensemble of five 19-channel noise samples and has been referred to as the MIP-19 for on-line use. The IP No. 8 provided signal-to-noise ratio improvements of one to two decibles (db) over a similar five-channel system (IP No. 6) for infinite velocity signals when tested with two noise samples from the ensemble for which the system was designed. But when tested against an independent noise sample, there was no appreciable signal-to-noise ratio improvement over the 5-channel case except at frequencies below one cps.

VESIAC 7811 VU

BALDWIN, R., J. BURG, E. BRYAN and M. BACKUS, Synthesis and Evaluation of Six Multi-Channel Filter Systems Based on Measured Correlation Statistics of Ambient Noise at Cumberland Plateau Observatory Designed to Operate on Rings of Seismometers, Contr. No. VT/077, AF 33(657)-12331, Texas Inst., Inc., Dallas, Texas, 1963.

Six isotropic multi-channel filter systems were synthesized from measured correlation statistics of noise at Cumberland Plateau Observatory. A quantitative evaluation of the systems was conducted with regard to signal-to-noise ratio improvement and transient response.

VESIAC 6889 VU

BALLARD, W. D., Seismic Survey of the Florida Keys, Contract No. VT/4051, AF 33(657)-12145, Geotechnical Corp., Garland, Texas, 1963.

The methods and results of seismic measurements recorded at various locations in the Florida Keys are reported. The instrumentation, operating procedures, analysis procedures, copies of data, and interpretation of these data are presented. Cultural disturbances had the greatest effect on the records at Florida City and noise generated by the ocean surf is most evident on the recordings from Duck Key, Florida.

VESIAC 14,962 VU
AD 489 161 L

BANCROFT, A. M., P. W. BASHAM, An FM Magnetic Tape Recording Seismograph, Tech. Rept., Rept. No. Res. Paper 38, Contract AF-AFOSR-702-64, Arctic Inst. of North America, Ottawa, Canada, 1966.

A three-component, S-P seismograph has been developed which uses frequency-modulated magnetic tape as the recording medium. The techniques for maintaining a well-calibrated system under field conditions are discussed in detail. Present methods for editing and conversion to a digital format are also described. The possibilities are explored for a modified system which produces additional L-P information from S-P seismometers.

VESIAC 12,430 VU

BARENBOIM, M. I., "Dynamic Characteristics of Refracted Waves in the Region of Inclined Salt Domes," Prikl. Geofiz. No. 10, pp. 84-96, 1953, (Translated from the Russian). Contract SD-78.

The results of seismic work conducted by using the method of reflected waves on salt dome structure of southern Emb lead to the hypothesis that at the periphery of the raised flanks there is a steep "shoulder" in the salt. However, using only data from reflected waves, it is not always possible to reliably determine the start of the steep dip of the salt.

VESIAC 19,759 VU
AD 855 345

BARNARD, T. E., Analytical Studies of Techniques for the Computation of High-Resolution Wavenumber Spectra, Advanced Array Research Spec. Rept. No. 9, Contract VT/7701, F33657-68C-0867, Texas Inst., Inc., Dallas, Texas, 1969

A theoretical study of several computational techniques for estimating wavenumber spectra is presented. Relationships among the techniques used for computing high-resolution wavenumber spectra are investigated. Stability and resolution of their estimates are compared. Methods for computing 2-dimensional maximum-entropy spectra are found to be impractical, and it is concluded that the maximum-likelihood technique provides the best estimate for most purposes.

BARON, R. G., W. VANDERKULK, and S. D. LORENZ, A LASA Signal Processing System, Contract: Agency Document, Advanced Research Projects Agency, Washington, D. C., 1965.

VESIAC 13,858-P VU
AD 648 415

This paper presents a processing system that will modularly handle the full range of signal processing techniques under consideration for the Large Aperture Seismic Array (LASA) system. Two system configurations are presented. The first assumes that only subarray processing is performed at the array site, and an alternative system considers all processing performed at the array site.

While either system is feasible, array site oriented processing offers substantial economies in both processing and data transmission requirements.

BASHAM, P. W., Time Domain Studies of Short Period Teleseismic P Phase, Final Rept., Contract AF-AFOSR 702-67, Arctic Inst. of North Am., Montreal, Canada, 1967.

VESIAC 17,999 VU
AD 670 191

Forty-one seismic events recorded on the plains of western Alberia are subjected to a detailed study in the time domain. A "P-detection" time-varying polarization filter is described and applied to the events to detect segments of strong P motion in the first 25 seconds of the P phase coda.

BATES, C. C., A Program for Cooperative Monitoring of the VELA UNIFORM Explosion Series by Commercial Geophysical Crews, Agency Document (Contract), Advanced Research Proj. Agency, Washington, D. C., 1961.

VESIAC 9177 VU

This document is the text of an address presented by Dr. Charles C. Bates to the 14th Annual Midwestern Exploration Meeting of the Society of Exploration Geophysicists, Oklahoma City, Okla. The text is a brief report on the status of a proposed cooperation effort in which the oil industry's seismic exploration crews would assist in recording data from underground nuclear explosions. The purpose of this recording is to improve the techniques for monitoring a nuclear test ban.

BATES, C. C., W. BEST, T. W. CALESS, C. KISSLINGER, ET AL., VESIAC Special Study Conference No. 2: An Evaluation of Today's Technique for Instrument Calibration and for Site Location, Contract No. SD-78, University of Mich., Inst. of Sci. & Tech., Willow Run Labs., Ann Arbor, Mich., 1962.

VESIAC 6513 VU

This report contains a record of the summary discussion of the VESIAC Special Study Conference No. 2, in addition to notes, comments, summaries, and elaborations of particular aspects of the subject. The main subjects are: Instrumentation, Instrument Calibration, and Site Location Criteria. Appendix I contains a short paper, "Note on Long-Period Noise in Seismographs," by G. H. Sutton; Appendix II contains a longer paper, "A Transient Technique for Seismograph Calibration," by A. F. Espinosa, G. H. Sutton and H. J. Miller. The appendices contain illustrative figures and bibliographies.

BÅTH, M., "Earthquakes and Nuclear Explosions Some Observations and Comments," Seismological Institute, University of Uppsala, Uppsala, Sweden, 1964, (Translated from Swedish), Contract SD-78.

VESIAC 12,667 VU

The authors consider the different aspects of earthquakes and explosions in somewhat greater detail than has been done previously, and compare these two types of disturbances. The difference in source mechanism, discussed here, could be used for identification purposes provided a sufficient net of stations, preferably for every 10^{o} in azimuth, and at comparable distances, were available. Time interval, location of the disturbance (i.e., whether it is in an area where earthquakes are unknown), and focal depth determination are considered in connection with determining whether a disturbance is natural or man-made. Some typical earthquake records are demonstrated, including the Novaya Zemlya explosion of October 31, 1961.

BÅTH, M., Fifth Semi-Annual Technical Summary Report for the Period July 1 to December 31, 1965, Rept. No. 32, Contract AF 61(052)-702, Seis. Inst., University of Uppsala, Uppsala, Sweden, 1966.

VESIAC 14,002 VU

Included in the report are research conducted under the contract and a bibliography of scientific reports which were produced under the contract through 31 December 1965. Four articles are appended to the report. They are: (1) "Application of Array Data Processing Techniques to the Swedish Seismograph Station," by E. S. Husebye and B. Jansson; (2) "On Least Squares Approximation by Rational Functions," by B. Jannson; (3) "Underground Measurements of Short-Period Seismic Noise," by M. Båth; and (4) "Lateral Variation of Rayleigh Wave Dispersion Character, Part III - Atlantic Ocean, Africa, and Indian Ocean," by T. Santo.

BÅTH, M., "Future Development of Seismic Station Networks," Scientia, Vol. 58, Ser. 6, pp. 1-8, 1964. (Translated from French), Contract SD-78.

VESIAC 12,843 VU

The present world network of seismic stations exhibits great differences with regard to instruments as well as the geographical distribution of stations. Modern seismic research clearly has attracted attention to the need for more uniform networks. A proposal for a world network with equal spacing is presented and discussed in relation with the various seismological problems, such as studies of seismicity, determination of magnitudes, study of the mechanism of earthquakes, and so forth.

BÅTH, M., Handbook on Earthquake Magnitude Determinations, VESIAC Special Rept., Rept. No. 7885-36-X, Contract DA 49-083 OSA-3137, University of Mich., I. S. T., Willow Run Labs., Geophys. Lab., Ann Arbor, Mich., 1969

VESIAC 19,671 VU
AD 687 977

A questionnaire was sent to all the seismological stations that make magnitude determinations to try to make some correlation between the various techniques used and the results obtained contained

In this report are the replies to these questionnaires. A discussion of various problems and suggestions are presented and a standard method for magnitude determinations is stated.

BÅTH, M., Methods of Analysis of Seismic Data, Second Semiannual Tech. Summ. Rept. No. 14, Contract AF 61(052) 702, Seismological Inst., Univ. of Uppsala, Uppsala, Sweden, 1964.

VESIAC 8643 VU
AD 669 511

This report gives the present research status in the following areas of study: (1) Higher mode surface waves. (The propagation of these waves over Eurasia have been analyzed and their energy characteristics in relation to earthquakes have been examined); (2) Deep-well and surface array data.

Three appendices which are booklets intended for publication are attached. They are: (1) Radar and Seismic Signal Detection by Enders A. Robinson, (2) The Isotropic Model of Microseisms by John F. Claerbout, (3) Some New Results in Spectral Estimation by B. Jansson. Each booklet contains an abstract written by the author.

BÅTH, M., Rheologic Properties of the Solid Earth, First Semiannual Tech. Status Rept., Contract No. AF 61(052)-588, Seis. Inst., Univ. of Uppsala, Uppsala, Sweden, 1962.

VESIAC 5575 VU

This report covers the period May 1 to June 30, 1962. The investigation is being carried out in three different directions: 1) collection of materials for strain release studies of the circum-Pacific seismic belt; 2) examination of the literature in preparation for laboratory studies of the behavior of scale models under stress; and 3) collection of articles preparatory to the development of a method to measure stress variations in the crust caused by earth tides and other related phenomena.

BÅTH, M., Rheologic Properties of the Solid Earth, Third Semiannual Tech. Rept., January 1 - June 30, 1963, Rept. No. 16, Contract AF 61(052)-588, Seismological Inst., Univ. Uppsala, Uppsala, Sweden, 1963.

VESIAC 9783 VU

This report continues the strain release studies of the circum-Pacific Seismic Belt and the laboratory studies of the stress distribution in models of geological bodies. Strain release studies were made of the 1960 Chilean earthquake sequence and the 1958 Alaskan earthquake. The two patterns had these things in common: the migration velocities increased toward the start of the sequence and were directed away from the region with highest stress concentration. A paper is attached on "Strain Release in Relation to Focal Depth."

BÅTH, M., Rheologic Properties of the Solid Earth, Fourth Semiannual Tech. Rept., Contr. No. AF 61(052)-588, Seis. Inst., Univ. of Uppsala, Uppsala, Sweden, 1964.

VESIAC 8641 VU

This report includes descriptions of research done in the following areas: 1) strain release studies (for the western part of North America and for non-Alpide Asia); 2) laboratory studies of scale models under stress; and 3) development of a method to measure stress variations in the crust. S. J. Duda's visit to the USA for study and research is reported. A short bibliography is included. The Appendix contains two complete manuscripts prepared by Duda and Barth. They are: "Earthquake Volume, Fault Plane Area, Seismic Energy, Strain, Deformation and Related Quantities;" and "The Stress Field Around a Fault According to a Photoelastic Model Experiment."

BÅTH, M., Rheologic Properties of the Solid Earth, Fifth Semiannual Tech. Rept., Contr. No. AF 61(052)-588, Seis. Inst., Univ. of Uppsala, Uppsala, Sweden, 1964.

VESIAC 8644 VU

Described are investigations and results concerning: 1) secular strain energy release in the time interval from 1897-1963 in different parts of the world; 2) strain energy release in the Prince William Sound Aftershocks from March 28, 1964, and the Kurile Islands Aftershocks from October 13, 1963; 3) local seismic activity in Arizona, as recorded at the Tonto Forest Seis. Observ. in Payson, Arizona; and 4) the meetings and observatories visited by Seweryn J. Duda during his stay in the United States. It was concluded that the strain energy release in different depth ranges does not occur independently; and an increase in one depth range is accompanied by a decrease in the intensity in the adjacent depth range.

BÅTH, M., Rheologic Properties of the Solid Earth, Sixth Semi-Annual Tech. Rept., 1 July - 31 Dec. 1964, Rept. No. 37, Contract AF 61(052)-588, AF 49(638)-1337, Seismological Inst., Univ. of Uppsala, Uppsala, Sweden, 1965.

VESIAC 18,320
AD 665 406

This semi-annual technical report discusses the purpose of the contract and the present research status of the program.

Results of the following are discussed: Regional seismicity and seismic wave propagation from records at the Tonto Forest Seismological Observatory, Secular Strain Energy release in the Circum-Pacific belt, and travels and institutes visited.

BÅTH, M., S. J. DUDA, Rheologic Properties of the Solid Earth, Final Rept., Rept. No. AFCRL 65-565, Contract AF 61(052)588, Univ. of Uppsala, Seis. Inst., Uppsala, Sweden, 1965.

VESIAC 12,020 VU
AD 619 388

This report lists the personnel, the development, conclusions of three year's research of the rheologic properties of the solid earth. References, publications and a statement of finance under the contract are also included. An Appendix is titled "Secular Seismic Energy Release in the Circum-Pacific Belt." It is based on data for the largest earthquakes (magnitude 7 or above) in the interval 1897-1964. Strain energy release and numbers of earthquakes are studied both in relation to time and space distribution. Two pronounced concentrations of strain energy release in the circum-Pacific belt are discussed. There is a general decrease in seismic activity in the period investigated.

VESIAC 18,334 VU
AD 650 505

BÅTH, M., Seismic Body Waves and Surface Waves, Annual Summ. Rept. No. 1, 1 January - 31 December 1966, Rept. No. 46, Contract AF 61 (052)-702, University of Uppsala, Uppsala, Sweden, 1967.

Most of the contract time has so far been spent on an investigation of the earthquake sequence which started February 4, 1965, in the Aleutian Islands region. The initial object of this work was to investigate whether stress relaxation in the aftershock region causes observable changes in the spectral composition of P waves from aftershocks. In a search for possible regularities, a detailed analysis of different properties of the sequence was undertaken.

VESIAC 18,658 VU
AD 672 809

BÅTH, M., Seismic Body Waves and Surface Waves, Annual Summ. Rept No. 2, 1 Jan. - 31 Dec. 1967, Rept. No. 59 AFCRL 68-0374, Contract AF 61(052)-702, Univ. of Uppsala, Seis. Inst., Uppsala, Sweden, 1968

This report is an annual summary report of work done on contract AF 61(052)-702. Chapters 1 and 2 are contained in this report and summarizes the work done previously and the present status of the contract.

VESIAC 17,979 VU

BÅTH, M., Seismic Body Waves and Surface Waves, Sci. Rept. No. 63, 1966-1967, Contract AF 61(052)-702, Univ. of Uppsala, Seismol. Inst., Uppsala, Sweden, 1968.

This report is a summary of the work done on a research program of body waves, on a broad basis. The studies include research on a number of items, such as particle motion, spectral analysis, focal mechanism, phase correlation, depth phases, core phases, channel waves in relation to higher mode waves, magnitude, signal and noise.

VESIAC 19,533 VU
AD 685 204

BÅTH, M., Seismic Body Waves and Surface Waves, Final Sci. Rept., 1 July 1963 to 31 December 1968, Rept. No. 75, Contract AF 61(052)-702, Uppsala Univ., Uppsala, Sweden, 1969

The report gives a review of the activities at the Seismological Institute, Uppsala, under contract AF 61(052)-702 in the interval from July 1963 to December 1968. The report is divided into the following sections: (1) Personnel; (2) Development of the contract project; a. Higher-mode surface waves; b. Deep-well and surface-array data; c. Fundamental-mode surface waves; d. Body waves; (3) Reports produced; and (4) Financial review.

VESIAC 8640 VU
AD 832 56[illegible] L

BÅTH, M., Seismic Surface Waves of Higher Modes, First Semiannual Tech. Summ. Rept., Rept. No. 8, Contract AF 61(052)-702, Seismological Inst., Univ. of Uppsala, Uppsala, Sweden, 1964.

Included in this report are: 1) a description of a higher mode surface waves study; and 2) a discussion of plans for future work on the higher modes. Attempts will be made to plot the dynamic dispersion for records with long trains of higher modes, to determine crustal structure by fitting theoretical higher mode dispersion curves, to examine the propagation of higher modes over Eurasia with records from various European and Asian countries, to obtain phrase velocities by correlating crests between tripartite stations with similar instruments, to discover whether Sa can be fitted into the higher mode dispersion curves, and to study factors which contribute to the presence of higher modes on records. An abstract of Crampin's Higher Modes of Seismic Surface Waves - Preliminary Observations.

BÅTH, M. and S. J. DUDA, Earthquake Volume, Fault Plane Area, Seismic Energy, Strain, Deformation and Related Quantities, Contr. No. AF 61(052)-588, Seis. Inst., Univ. of Uppsala, Uppsala, Sweden, 1964.

VESIAC 8641 A VU

Benioff initiated strain release studies around 1950. Since that time the same method as originally given by Benioff (1951), has been used by all who have worked in this field, including the authors of this article. In the original method, strain is proportional to the square root of the released seismic energy. The volume of every aftershock was considered constant and equal to the total volume of the aftershock zone. The fraction of elastic energy converted into seismic energy was also assumed constant. Moreover, an older energy magnitude formula has been used for consistency reasons, although newer and better formulas have been developed in the meantime. In this paper, an effort to improve Benioff's method is described, especially in the directions mentioned.

BEABOUT, E. G., H. K. HARRIS, F. R. HOWARD, and B. F. KIMLER, et. al., Ocean-Bottom Seismograph Production and Gulf of Mexico Data Analysis, Final Rept., Contract VT/8701, F33657-68C-0242, Texas Inst., Inc., Dallas, Texas, 1968

VESIAC 19,040 VU
AD 840 743

Six additional Ocean-Bottom Seismographs, similar in design and functionally interchangeable with existing units, were produced. Results of testing the new units showed that system performance is not measurably affected by the unit modifications and that the replacement Hall-Sears seismometer package is operationally similar to the EV-17 but is more dependable.

BECKER, H., Determination of the Seismic Radiation Field from a Model Fault in the Near Source Region by Means of Dynamic Photoelastic Studies, Semiannual Rept., ARA-263-9, Contract AF 19(628)-4012, Allied Res. Assoc., Inc., Concord, Mass., 1964.

VESIAC 9790 VU

Described is a project for the development of a shear fracture in a rectangular plane as the result of essentially pure shear loading, the development of a mechanism whereby shear fracture can be produced under controlled conditions, the development of a loading device to induce shear fracture in a uniform shear field, and a process for recording stress wave patterns as a result of the fracture. Preliminary results demonstrate the soundness of the principle employing the recohered crack as a means of generating radiation patterns from shear fracture.

BELL TELEPHONE LAB. (STAFF), An Investigation of Auditory Discrimination Techniques as Applied to Project VELA UNIFORM, Contract ARPA Order No. 192-64, Bell Telephone Lab., New York City, N. Y., 1964

VESIAC 9281 VU
AD 453 643

This report describes experiments performed and experimental data obtained to permit a critical evaluation of auditory discrimination between earthquakes and underground nuclear explosions.

Since the listening experiments in this report used an experimental method different from that employed by Speeth and Franti, the first section gives a description and rationale of the technique used here. Then, results of the two major listening experiments are given, followed by the results of the physical measurement program and their relation to the results of the second of the two listening experiments. Finally, conclusions concerning the utility of auditory discrimination for detection, as well as recommendations are given.

BELOUSOV, V. V., "On the Value of Deep Seismic Sounding in the Solution of Theoretical and Practical Questions of Geology," USSR Acad. of Sci., Inst. of Geophys., Address Unknown, Undated-Received 1966, (Translated from Russian), Contract DA 49-083 OSA-3137.

VESIAC 14,635 VU

The author points out that knowledge of the regularities of the development of tectonic and magmatic processes is absolutely necessary not only for theoretical purposes, but also for the solution of practical problems; for the prediction of the composition and structure of a given section of the earth's crust (for the prediction of the distribution of minerals) or for the prediction of seismicity. It is for this reason that the author recommends seismic sounding to a depth of about 1000 km.

BENIOFF, H., Earthquake Source Mechanisms, Contract No. AF-AFOSR-355-62, Calif. Inst. of Tech., Berkeley, Calif., 1964.

VESIAC 7342 VU

The elastic rebound theory of Reid provides a satisfactory mechanism for the immediate source mechanism of shallow and probably intermediate depth earthquakes. Deep earthquakes appear to involve volume collapse either with or without associated faulting effects. Our knowledge of the origin of secular strains which provide the elastic rebound energy is in an unsatisfactory state. Strike-slip and dip-slip faults very likely involve different strain generating mechanisms. No mechanism proposed to date for generating either strike-slip or dip-slip strains has achieved general acceptance.

BENIOFF, H., Study of Free and Forced Oscillations of the Earth - Final Progress Report, Grant AF-AFOSR-62-355, Calif. Inst. of Tech., Pasadena, Calif., 1964.

VESIAC 8883 VU
AD 424 117

This report is primarily concerned with descriptions of alterations, additions, and modifications to the physical plant of Caltech's seismological Laboratory. Construction of the tunnel at the Lake Isabella Station is described; under the heading "Electronics" are described the installation and evaluation of servo systems, special recording thermographs, an interferometer system, two independent centering techniques, a sensitive barometric pressure transducer, four Leeds and Northrup analog chart recorders, and an AC inverter. Additional experiments are being run on a rotational seismometer to differentiate between the rotational and compressional components of seismic waves, and a long-period liquid mercury pendulum seismometer.

BENIOFF, H., and S. W. SMITH, Study of Free and Forced Oscillations of the Earth, Contract AF 49(638)-1299, California Inst. of Technology, Pasadena, California

VESIAC 12,852 VU

The major experimental programs supported by this contract have been described in the Final Progress Report, AFOSR Grant No. 62-355 for 1 July - 30 September 1963. Those projects that were underway but not yet completed at that time will be reviewed here: (1) Rotational Seismometer; (2) Mercury Pendulum; (3) Strain Seismograph; and (4) Data Analysis.

BEN-MENAHEM, A., Deformation of a Non-Gravitating Elastic Sphere by a Finite Internal Dislocation, Rept. No. 292-63, Contract AF 49(638)-1337, Calif. Inst. of Tech., Pasadena, Calif., 1965.

VESIAC 11,760 VU

An explicit tractable representation is obtained for the deformation of a non-gravitating stratified elastic sphere by a shear dislocation of arbitrary orientation and depth. The Papkovich solution of the elastostatic equilibrium equation is expanded into series of vector spherical harmonics and the Haskell-Gilbert matrix method is shown to be applicable. A close form solution is obtained for the test case of a homogeneous sphere. This solution can be derived alternatively from the dynamic analogue at the limit of zero frequency.

A Green function is obtained from which the solution for finite dipolar sources is derived. Properties of the displacement field are discussed.

BEN-MENAHEM, A., Source Studies from Isolated Seismic Signals, Rept. No. 7885-1-X, Contract AF 49(638)-1337 - DA 49-083 OSA 3137, SD-78, Calif. Inst. of Tech., Pasadena, Calif., 1967.

VESIAC 15,915-F VU

The author outlines the historical development of source mechanism determinations and demonstrates the present state of the art by a few examples which show clearly the success, as well as the limitations, of existing methods. Some new data are presented.

BEN-MENAHEM, A., Summation of Certain Legendre Series and Related Difference Equations, Contract AF 49(638)-1337, Calif. Inst. of Tech., Pasadena, Calif., 1965.

VESIAC 12,581 VU

This paper gives a summation method for Legendre series. This is achieved by transforming the sum into an integral which in turn leads to a set of difference equations. A general solution of these equations is obtained in terms of finite series of certain Legendre functions.

The summation method given here can be used for other series with similar structure.

BEN-MENAHEM, A., S. W. SMITH, and T. TENG, A Procedure for Source Studies from Spectrums of Long-Period Seismic Body Waves, Contract AF 49(638)-1337, California Institute of Technology, Pasadena, Calif., 1964.

VESIAC 10,193 VU
AD 617 039

The well-known first motion method of Nakano and Byerly is extended, generalized and combined with recent new ideas in body wave theory in order to set up a routine procedure for extracting source parameters from spectral analysis of isolated P and S pulses recorded at a net of standardized stations around a non-shallow source. The method consists of compensating the observed spectrums for instrumental and propagational effects. A combined study of the resulting radiation patterns, initial phases, and the initial amplitudes will render information regarding the spatial and temporal nature of deep and intermediate earthquake sources as seen through the spectral window of 10-100 sec. Described is when shorter periods can be used for source studies.

BENNO, S. A., R. D. BAUER, Evaluation of the CPO Multichannel Filter Processor CPO, No. 4, Project VT/6704, Contract AF 33(657)-14648, Texas Inst., Inc., Dallas, Texas, 1967.

VESIAC 16,662 VU

In the evaluation of the system as a detection device, results showed a 55-percent increase in the number of reported events from July to September 1966. Other analysis for February and March 1967 showed that CPO recorded most events of magnitude ≥ 4.3; but at lower magnitudes, CPO was able to detect small events from the southern hemisphere while missing most large events from the northern hemisphere. Results comparing the number of reported events in 1967 using processor and primary data showed that the analysts compiling the primary data list had gained the ability to recognize small signals and groups of waves as true seismic events from their previous MCF-analysis work. Perceptibility curves computed for the February and March 1967 data showed analysts able to recognize events as much as 0.5 magnitude lower than before the processor was installed.

BENTLEY-LLEWELLYN, N. J., Study of a Three-Dimensional Seismic Detection System, Final Rept., Contract AF 49(638)-1084, Century Geophysical Corp., Tulsa, Oklahoma, 1963.

VESIAC 7471 VU

In this study, the feasibility of instrumenting a three-dimensional array for long term operation has been demonstrated effectively for the first time. The ability to beam a subsurface three-dimensional array in a unidirectional manner, and its signal-to-noise improvement potential, indicate that arrays of this type have merit. This is particularly true when seismological observatories need to be located in areas in which the high surface noise level restricts detection and identification capability of surface arrays.

BERCKHEMER, Dr. H., Investigation of the Dynamical Process in Shallow and Deep Earthquake Foci by Analyzing the Pulse Shape of Body Waves, Annual Rept. No. 1, AF 61(052)-801, Institut Ufr. Meteorologic Und Geophysik, Frankfurt Am Main, Germany, 1965.

VESIAC 13,400 VU

A microfilm library of WWSSN seismograms has been established at Frankfurt. Equipment to convert seismogram traces into electric analogue values has been designed and built. Model calculations of body wave pulses from extending earthquake foci serve as an aid for the interpretation of seismograms.

BERCKHEMER, H., Investigation of the Dynamical Process in Shallow and Deep Earthquake Foci by Analyzing the Pulse Shape of Body Waves, Annual Report No. 2 for 1 June 1965 to 31 May 1966, Contract AF 61(052)-801, Inst. fur Meteorologie und Geophysik, Frankfurt am Main, Germany, 1966.

VESIAC 14,811 VU

An analog-to-digital converter has been built for use on USC&GS seismograms on microfilm. Certain seismic events have been selected for the investigation of focal processes.

BERCKHEMER, H., Seismic Anomalies and Crustal Structure in Germany, Contract SD-78, Univ. of Mich., I. S. T., Ann Arbor, Mich., 1966.

VESIAC 13,999 f VU

This paper summarizes recent studies on seismic anomalies by a number of investigators, primarily from West Germany.

BERCKHEMER, H., and B. AKASCHE, Seismic Ground Noise and Wind at the Seismological Observatory Graefenberg, Special Scientific Rept. No. 1, Contract AF 61(052)-861, Geophys. Inst., Tech. Univ., Karlsruhe, Germany, 1966.

VESIAC 14,976 VU

Seismic ground noise and its relation to local wind conditions have been studied at the LRSM seismograph station at Graefenberg, Germany. Results have been reached on the following: (1) the composition of the noise level of long-period horizontal ground movement; (2) the fact that the orbits of the short-period ground movement show similarity to surface waves of different types; (3) the fact the frequency analysis of records from long-period horizontal seismograms has a maximum in spectral amplitude between 40 and 70 sec; (4) the fact that the spectral amplitude of the wind pressure fluctuations increases linearly with the period between 0.1 and 2.0 sec. In two appendices, an anemometer and a "search circuit" for frequency analysis with an electric analog computer are described.

BERCKHEMER, H. and K. H. JACOB, Investigation of the Dynamical Process in Earthquake Foci by Analyzing the Pulse Shape of Body Waves, Final Sci. Rept., 1 June 1964 to 31 December 1967, Contract AF 61(052)-801, Inst. of Meteor. & Geophys., Univ. of Frankfurt, Frankfurt, Germany, 1968

VESIAC 18,775 VU

The shape of recorded teleseismic P-wave pulses is used to describe earthquakes in terms of propagating dislocations. The disturbing influences of seismograph system and wave propagation through the earth's mantle and crust on the pulses are taken into account as as far as possible or necessary. Model computations of synthetic body-wave pulses radiated from various types of propagating sources serve as a mean to interpret observed pulses. The analysis is carried out to some extent in the time domain and partially in the frequency domain.

BERCKHEMER, H., and K. H. JACOB, Synthetic Seismic Pulses from Propagating Faults, Scientific Report No. 1, Contract AF 61(052)-801, Johann Wolfgang Goethe Universitat, Frankfurt am Main, Germany, 1965.

VESIAC 14,112 VU

A simple numerical method is presented to calculate the displacement pulses of body waves radiated from extending fault planes in a homogeneous medium. Seismic pulses for extending sources are obtained as a superposition of the displacements from delayed point sources. The variability of the focus model includes: the final focus shape, final focus size, geometry of fracture propagation, fracture velocity and its variation with focus expansion and the type of force system. Certain statistical properties of the focal models are discussed. Also, a computer is described which serves for the numerical calculations of the displacement pulses radiated in different directions as well as for further treatments such as spectral analysis, convolution with seismograph response, calculation of seismic energy density. Results are plotted for various focus models.

BERCKHEMER, H., and N. J. OLIVER, "Interpretation of Seismic Arrivals with Parallel Travel Time Curves," Ztschr. f. Geophys., Vol. 21, pp. 152-164, 1955. (Translated from German), Contract SD-78.

VESIAC 9534 VU

By means of a model experiment, an attempt is made to explain the nature of the so-called parallel arrivals observed in seismic refraction studies, particularly by H. Reich. The observed "parallel" arrivals are attributed to critical, or near critical reflections within the upper layer. The surprisingly large amplitudes of these waves in comparison with those of the direct P-wave are explained when it is realized that the observed surface motion of the direct P-wave is, indeed, a second order effect also. The process may take place in each layer of a multilayered medium, including cases where the underlying layer is of slower velocity, providing only that sufficient discontinuity in velocity and density exists.

BEREZIN, E. M., and V. A. KUZIVANOV, "Nomograms for the Determination of Corrections for Amplitude, Temperature and Depth of Submersion, for the Correction for the Eotvos Effect, and of the Coefficient of Co-Oscillation in Pendulum Observations at Sea," Trudy Inst., Fiziki Zemli, Akad. Nauk, SSSR, No. 8, pp. 72-79, 1959. (Translated from Russian), Contract DA 49-083 OSA-3137.

VESIAC 15,280 VU

Several nomograms are proposed which facilitate the processing of marine pendulum observations.

BERG, E., Crustal Deformation, Release, Failure and Tilts in Alaska, Tech. Rept., Contract F44620-70C-0031, Univ. of Alaska, College, Alaska, 1970

VESIAC 20,292 VU

This technical report summarizes work done for the period under the following headings: Telemetry Network, Seismicity, Crustal Structure, and Failure in an Earthquake zone.

BERG, E., Crustal Deformation, Release, Failure and Tilts in Alaska, Tech. Rept., Contract F44620-70C-0031, Univ. of Alaska, College, Alaska, 1970

VESIAC 20,454 VU

This paper reports on the telemetry network operations being maintained in Alaska and on the seismicity studies being done with the data from the network.

VESIAC 15,040 VU

BERG, E., Deformation Release and Failure in an Earthquake Zone, Contract AF-AFOSR-701-66, Univ. of Alaska, College, Alaska, 1966.

Deformation release in an earthquake zone is interpreted as the non-elastic part of the stress-strain curve leading ultimately to ductile failure. A similarity to the fracture propagation in aluminum is pointed out. The time interval found to accomplish the non-elastic part of the stress-strain curve in an earthquake zone is of the order of 1 year for a large shock and similar to those found by tilt recordings in other areas. Two examples for the Aleutian Arc and Alaska are presented.

VESIAC 14,452 VU
AD 636 967

BERG, E., Fundamental and Applied Research in Seismology in Alaska, Final Rept., Contract AF-AFOSR-701-64, Univ. of Alaska, College, Alaska, 1966.

Two permanent and one semi-permanent seismic stations have been established. An earthquake catalog, which makes use of all available sources has been compiled, including earthquakes up to Summer 1965. Energy release of the Aleutian Chain, Alaska, and the Southeast has been studied and mapped. Also included is a discussion of the fault plane solutions of the earthquake of March 1964.

VESIAC 16,517 VU

BERG, E., Tectonic Movements and Deformation Release in Alaska, Contract AF-AFOSR-701-66, University of Alaska, College, Alaska, 1967.

In this report, the seismograph network that was established by the University of Alaska is described, the location and classification of earthquakes is discussed, and the specific research accomplishments to date are outlined.

VESIAC 18,782 VU

BERG, E., Tectonic Movement and Deformation Release in Alaska, Final Rept., 1 January 1966 to 30 November 1967, Contract AF-AFOSR 701-66, Univ. of Alaska, Geophys. Inst., College, Alaska, 1968

This report covers the research effort of the seismology-volcanology section. The University's Geophysical Institute has established the large telemetry network, and accurate epicenter location of even small shocks is now routine work. Crustal structure determination in the Tanana Basin were attempted. The Fairbanks earthquakes and aftershocks in June highlighted the necessity for further studies and yielded interesting outlooks on the mechanics of pre-failure stress.

VESIAC 19,267 VU

BERG, E., Tectonic Movement Deformation Release and Crustal Structure Studies in Alaska, Annual Rept., Contract F44620-68C-0066, Univ. of Alaska, Geophys. Inst., College, Alaska, 1968

This report covers the following Tasks: (A) The research effort conducted during the contract period; (B) The data transmission to the IBM Seismic Array Analysis Center; and (C) The installation of three borehole seismic instrument packages.

VESIAC 19,539 VU

BERG, E., Tectonic Movement Deformation Release and Crustal Structure Studies in Alaska, Quarterly Rept., Contract F44620-68C-0066, Univ. of Alaska, College, Alaska, 1969

Operation of the six main stations has continued. Two additional vertical seismometers have been operated and recorded. These two stations form a tripartite net with the main station PJD. Epicenters of local earthquakes inside the network have been determined for magnitudes >2 and mapped. Work has continued on the Gilmore-Pedro Dome link.

Work on the azimuthal distribution of horizontal tectonic pressure axis from fault plane solutions of earthquakes inside the network has continued. A comparative study of the magnitude determination at individual telemeter stations is in progress. The study of crustal velocities in central Alaska continues as well as the micro-earthquake investigation in the Fairbanks June 21, 1967 earthquake aftershocks.

VESIAC 19,665 VU

BERG, E., Tectonic Movement Deformation Release and Crustal Structure Studies in Alaska, Quarterly Rept., Contract F44620-68C-0066, Univ. of Alaska, College, Alaska, 1969

During the report period the large aperture telemeter network in Alaska had been operated with the six main stations BIG, SVW, TNN, PJD, BLR and SCM (U. S. C. & G. S. Station Code). Two additional vertical seismometers have been operated and recorded, one southeast of Fairbanks (telemeter station) and the other at the Geophysical Institute. These two stations form with PJD (north of Fairbanks) a tripartite net to study the continued seismic activity in the Fairbanks area.

Teleseismic P-wave arrival times have been transmitted to the Coast and Geodetic Survey in Washington, D. C. Epicenters of local earthquakes inside the network have been determined monthly for magnitudes > 2 and mapped.

VESIAC 20,128 VU
703 748

BERG, E., Tectonic Movement, Deformation Release and Crustal Structure Studies in Alaska, Final Rept. 1968 & 1969, Contract F44620-68C-0066, Univ. of Alaska, Geophys. Inst., College, Alaska, 1970

The seismic telemeter system data now cover a total of three years record for central Alaska. Monthly epicenter maps for the contract period are given. The tectonic pressure axis have been determined using earthquakes occurring in the network. Three borehole packages of the USO type have been installed in Gilmore, Paxson and McKinley. It was found that the construction of the long-period part of the borehole package makes the LP-X component a very sensitive microbarograph, covering the period range from 15 sec to DC. Tilts associated with local earthquakes of small magnitude at short distances are discussed.

Laboratory results on brittle rock failure seem to be valid for the earth crust. If foreshocks occur at all, the "b" slope of the Gutenberg-Richter Relation, linking the log of the number to the magnitude of the earthquakes, seem to indicate high average stress levels for small areas and prior to a small main shock, the larger areas associated with relatively stronger earthquakes seem to be associated with lower average stress levels.

VESIAC 13,547 VU

BERG, E., Triggering of the Alaskan Earthquake of March 28, 1964 and Major Aftershocks by Low Ocean Tide Loads, AF-AFOSR-701-64, Univ. of Alaska, College, Alaska, 1965.

This study indicates that the March 28 Alaskan earthquake and aftershocks of $m_B \geq 5.5$ (except for the first day) and located on the continental shelf have possibly been triggered by low ocean tide loads. The observation is consistent with the principal compressional stress system deduced from fault plane solutions, the stress variations of the ocean tidal loading being high enough to act as the triggering force.

VESIAC 16,731 VU
AD 663 237

BERG, E., L. GEDNEY, S. KUBOTA, and K. HANSON, The June 21, 1967 Earthquake Series at Fairbanks, Alaska: Aftershock Locations, Depths and Magnitudes, Rept. No. UAG-R-193, Contract AF-AFOSR-701-66, Univ. of Alaska, College, Alaska, 1967.

Recordings of about 50 aftershocks have been used to determine the extent of the fracture area for the 21 June 1967 earthquakes. The area was found to be about 10 × 15 km with the major axis roughly oriented in a NW-SE direction. Hypocenter depth varies from 6 to 19 km, with most of the shocks being confined to a depth of 10 to 13 km. It was found that the Jeffreys-Bullen velocities, $V_p = 5.56$ and $V_s = 3.37$ km/sec, represent a close approximation of the velocities in the area. Presented also are the telemeter network readings from June 21, 1800 GMT, to July 14 which include the aftershocks of magnitude 2.5 and upward.

VESIAC 13,546 VU

BERG, E., and S. KUBOTA, LONGSHOT, Seismic Recordings in Central Alaska, AF-AFOSR-701-64, University of Alaska, College, Alaska, 1965.

Experiment Longshot was recorded by six stations through Central Alaska and the recordings are presented. A total of six stations have been operated by the seismic group: McKinley, Tanana, Brooks, Black Rapids, Circle Hot Springs, and Paxom. The instrumentation at these stations is discussed, as well as station times, coordinates and altitudes of each station, calibrations, higher filter settings, arrival times, direction of first motion and its amplitude. In all stations, the signal-to-noise ratio has been high enough to record the relatively weak first compressional half cycle with amplitudes ranging from 6 to 13 millicrons.

VESIAC 15,022 VU

BERG, E., S. KUBOTA, and J. KIENLE, Preliminary Determination of Crustal Structure in the Katmai National Monument, Alaska, Contract AF-AFOSR-701-64, Univ. of Alaska, College, Alaska, 1966.

Seismic and gravity observations were carried out in the volcanic area of Katmai in the summer of 1965. A determination of hypocenters has been attempted using S and P arrivals at a station located at Kodiak and two stations located in the Monument. However, in most cases, deviations of travel times from the J-B tables were rather large. A method based on P- and S-wave arrivals yields a Poisson's ratio of 0.3 for the upper part of the mantle under Katmai. Average depth to the Moho from data in the same area is 38 km and 32 km under Kodiak.

BERG, E., S. LUKASIK, I. SIMON, and R. FAYLOR, et. al., Summaries of Papers Presented at Project VELA-UNIFORM AFCRL/AFOSR Contractor Review, 4-5 April 1968, Rept. No. 7885-33-T, Contract DA 49-083, OSA-3137, Univ. of Mich., WRL, Inst. of Sci. & Tech., Ann Arbor, Michigan, 1969

VESIAC 19,979 VU

This report contains summaries or complete texts of 30 papers presented at the Project VELA UNIFORM AFCRL/AFOSR contractor review conference which was held in Arlington, Virginia, in April 1968. The investigations cover the range of seismology from seismic arrays, through signal anomalies and travel times, to source mechanisms, and come from the United States, France, Africa, Sweden, and Germany.

BERG, E., and R. RASMUSSEN, The Effect of Barometric Pressure Variation on the "U. S. O." Long-Period Seismometer, Tech. Rept., Contract F44620-68C-0066, F44620-70C-0031, Univ. of Alaska, College, Alaska, 1970

VESIAC 20,184 VU
AD 703 753

The particular manner of mechanical construction of the Long-Period U. S. O. package is responsible for the pressure sensitivity of the LP-X component. The effect seems to be linear with pressure for periods larger than the seismometer period and short compared to the feedback signal time constant. Under the particular setting of the Gilmore (GLM) installation, a pressure induced displacement of the x component is $\frac{\Delta x}{\Delta p} = \frac{-13.8 \text{ mu}}{\mu\text{bar}}$ (without feedback).

Since the pressure induced displacements are considered as very undesirable noise for the instrument as either long period seismometer or as tiltmeter the borehold was pressure sealed and the effect removed. Records are presented to demonstrate the effect.

BERG, E., N. SPERLICH, and W. FEETHAM, Large Aperture Seismic Telemetering System for Central Alaska, Contract AF-AFOSR-701-66, Univ. of Alaska, College, Alaska, 1967.

VESIAC 16,660 VU

The Geophysical Institute has established and now operates a large aperture seismic telemeter network in Alaska. At present (May 1967) five stations are operated and one more will be added shortly.
The system is described in its technical details, including the remote site equipment and the method of recording at the Geophysical Institute.

BERG, J. W., The GNOME Explosion and its Bearing on Nuclear Test Detection, Contr. No. SD-50, Inst. Defense Analyses, Wash., D. C., 1962.

VESIAC 8759 VU
AD 428 227

The GNOME nuclear explosion was detonated in salt underground at Carlsbad, N. M. on 10 December 1962. This explosion was probably the best documented explosion in history. The object of this report is to assess the early analyses of the seismic data from the GNOME explosion in its relation to nuclear test detection. To do this, the report is divided into three sections: 1) Source (The GNOME source in salt gave essentially the same signal strength as the RAINIER source in tuff scaled to 5 KT); 2) Propagation paths and recording sites; and 3) Effects on the Geneva criteria. No major breakthrough in the area of detection methods were evident for the GNOME explosion seismic results.

BERG, J. W., Theoretical and Field Studies of Seismic Waves, Final Research Rept., 1 April 1962 to 1 April 1964, Contract AF-AFOSR-62-376, Oregon State Univ., Corvallis, Oregon, 1965.

VESIAC 9784 VU
AD 612 033

The goal of the research was to determine a method for evaluating the size of a seismic source using amplitudes and/or energy content of the seismic waves generated by the source. Each distance range (local, near-regional, regional, and teleseismic) was considered separately to divide the major problem into several smaller ones. During the report period only the initial seismic disturbance was considered for this work. Eventually, this work should involve other phases as well as the initial P waves that were considered. Data recorded from Gnome, Hardhat, Haymaker, and Shoal nuclear explosions were chosen to represent the seismic sources for this work

BERG, J. W. and T. LONG, Character of Refracted Arrivals, AF-AFOSR-49(638)-1403, Oregon State Univ., Corvallis, Oregon, 1965.

VESIAC 12,558 VU

A method is described which has been developed to distinguish a refracted wave that has been returned to the surface by a positive velocity gradient (direct wave) from a refracted wave that is bound to an interface and constantly radiates energy to the surface of the lower velocity medium (head wave). Based on the theory of head waves and direct waves, this method utilizes the fact that the head wave is proportional to the integral of the direct wave. Two criteria are given for discrimination between the refracted arrivals.

BERIKASHVILI, V. SH., V. N. ZHARKOV, and T. B. YANOVSKAYA, "On the Velocity Profile of the Moon," Akad. Nauk., SSSR, Izv. Fiziki Zemli, No. 7, pp. 9-21, 1965, (Translated from Russian). Contract DA-49-083 OSA-3137.

VESIAC 13,313 VU

The question of the distribution of the velocities of P and S waves in the depths of the moon is examined. Use is made of the results of laboratory measurements of the influence of pressure, temperature and composition on the velocity of elastic waves in rocks, and also data on the distribution of P and S waves in the upper layers of the earth. It appeared that the moon should have an anomalously broad layer of reduced velocities. The reason for this is that the critical temperature gradient for the formation of a slow-velocity layer is proportional to the acceleration of gravity and on the moon this value is one-sixth as large as on earth. Also, a disturbance of the Wiechert conditions below the lunar surface might exist.

BERZON, I. S., "Approximate Methods of Quantitative Analysis of Isochrone Charts of Reflected Waves," Izv., Akad. Nauk SSSR, Ser Geofiz., No. 3, pp. 252-262, 1956, (Translated from Russian), Contract DA 49-083 OSA-3137.

VESIAC 15,133 VU

Approximate methods of interpretation of isochrone charts of reflected waves for non-planar interfaces with small angles of inclination are explained.

BERZON, I. S., "On the Calculation of the Horizontal Velocity Gradient in Covered Media in Interpreting the Travel-Time Curves of Refracted Waves," Trudy Geofiz. Inst., Akad. Nauk, SSSR, No. 35, pp. 258-268, 1956, (Translated from Russian), Contract DA 49-083 OSA-3137.

VESIAC 17,309 VU

The problem of errors in determining the angles of inclination of refraction boundaries due to the neglected horizontal velocity gradient $\overline{V}$ in the covered medium is examined.

The author presents an approximate method for calculating the horizontal velocity gradient $\overline{V}$ while interpreting the travel-time curves of refracted waves.

BERZON, I. S., "Some Questions in the Interpretation of Time-Distance Curves of Reflected Body Waves," Trudy Inst. Fiziki Zemli, Akad. Nauk SSSR, No. 6, pp. 213-235, 1959, (Translated from Russian), Contract DA 49-083 OSA-3137.

VESIAC 15,281 VU

Methods are proposed for determining the velocities of transverse waves on time-distance curves of reflected body waves in the case of single-layer and two-layer covering media. With the proposed methods, it is possible to determine the type of recorded body waves simultaneously. Examples are given for the analysis of the types of body waves and determination of the velocities according to experimental time-distance curves of body waves.

BESPYALTOV, B. I., "Certain Problems Related to the Theory of Multichannel Recording in Seismic Exploration," Priladnaya Geof, Vol. 25, pp. 20-36, 1960, (Translated from Russian), Contract SD-78.

VESIAC 11,979 VU

From 1955-1958, a large volume of experimental work was carried out in the Saratov and Stalingrad regions along the Volga by the lower-Volga section of the VNIIGeofizika and by the seismic laboratory of the VNIIGeofizika relating to multichannel recording. This work involved the analysis of a number of theoretical and practical problems; especially important were the method of analysis developed for the directional effect in an impulse system of oscillations, and the statistical effect of various interference systems (among them, multichannel recording with seismic receivers), as well as a procedure for studying a wave picture yielding data for determining the optimum parameters of multichannel recording with seismic receivers using this method.

BESSONOVA, E. N., "The Propagation of Longitudinal and Transverse Plane Waves in an Infinite Viscoelastic Maxwellian Medium," Akad. Nauk SSSR Trudy Inst. Fizik. Zeml., No. 11, pp. 155-172, 1960, (Translated from Russian), Contract SD-78.

VESIAC 13,372 VU

In this report it is demonstrated mathematically that when a nonstationary plane wave passes through a Maxwell medium, its shape, velocity, and intensity change greatly in the process of propagation. In the case of transverse waves, the original vibration decays exponentially, and in place of it a L-P vibration forms which decays little, but is also of very low intensity. In the case of longitudinal waves, the initial disturbance, proceeding with the velocity a, gradually is transformed into a smoother disturbance proceeding with a definite velocity. It follows from the presented calculations that the relaxation of time T in the upper part of the core satisfies a number of stated inequalities.

BEST, W. J., R. CABRE, Peñas Seismic Array Operations and Study of Aftershocks in Central Andes, Sci. Rept., Contract AF-AFOSR 792-65, San Calixto Inst., La Paz, Bolivia, 1969

VESIAC 19,277 VU

Several changes in instrumentation were made in the seismic array, tyse LRSM, near the village called Peñas, 55 km. from La Paz. Basic problems of seismicity and crustal structures of the Andes region have been studied and are abstracted in this report.

BINDER, F., Array Research - A Study of Directional Wiener Filtering Using the TFO Crossarray, Special Report No. 14, Contract VT/4053, AF 33(657)-12747, Texas Instr., Inc., Dallas, Texas, 1966.

VESIAC 15,737 VU

The purpose of this study is to determine the effectiveness of directional processing using the TFO crossarray.

Directional multichannel filter systems were designed using measured-noise correlations and a specific high-velocity plane wave as signal. Then, the noise used in the design was computer-processed and compared to an infinite velocity processor, a straight summation, and where possible, a beam-steering.

BINDER, F. H., Correlation Between Storms at Sea and LASA Long-Period Noise - Large-Array and Noise Analysis, Special Sci. Rept. No. 17, Project VT/6707, Contract AF 33(657)-16678, Texas Inst., Inc., Dallas, Texas, 1967.

VESIAC 17,435 VU
AD 826 821

Wavenumber and frequency spectra of nine long-period noise samples recorded at the Montana LASA were compared to wave-height charts for the nearest available time. No attempt is made to give a comprehensive explanation of the relationships between seawave activity and long-period seismic noise.

A study of these nine noise samples suggests that, in general, the spatial organization of the LASA long-period noise cannot be predicted by examination of wave-height charts. With one exception, strong point-like noise sources generally seem to be associated with areas of high wave activity impinging on a land mass. Strong wave activity in the Pacific Basin not in contact with any land mass does not generate observable long-period noise. Relatively quiet days do not show areas of strong wave activity impinging on land masses.

BINDER, F. H., K-Line Spectral Analysis of LASA Short-Period Summer Noise, Special Rept. No. 18, Large-Array Signal and Noise Analysis, Contract VT/6707, AF 33(657)-16678, Texas Inst., Inc., Dallas, Texas, 1968

VESIAC 18,527 VU
AD 835 372

This report discusses some additional applications of K-line spectra to the LASA short-period noise analysis. Two summer noise samples were processed to compliment the work performed previously on eight winter noise samples. In addition, an experiment was conducted to determine if significantly better results could be obtained using 21 min of noise instead of 7 min to estimate the statistics.

BINDER, F. H., Large Array Signal and Noise Analysis, Quarterly Report No. 3, 3 December 1966 Through 2 March 1967, Contract VT/6707, AF 33(657)-16678, Texas Instruments, Inc., Dallas, Texas, 1967.

VESIAC 16,072 VU
AD 813 146

This report describes the work done on Project VT/6707, contract AF 33(657)-16678 for the period, December 3, 1966 through March 2, 1967.

BINDER, F. H., Large-Array Signal and Noise Analysis, Quarterly Rept. No. 5, Project VT/6707, Contract AF 33(657)-16678, Texas Inst., Inc., Dallas, Texas, 1967.

VESIAC 17,029 VU
AD 822 404

This quarterly report is a summary of the progress on LASA Evaluation during the period 26 June 1967 through 30 September 1967. Progress is reported on the following studies: (1) short and long period noise analysis; (2) signal dissection; and (3) high resolution spectra of short-period signals.

BINDER, F. H., Large-Array Signal and Noise Analysis - Rept. No. 12 - Analysis of Long-Period Noise, Special Sci. Rept., Contract VT/6707, AF 33(657)-16678, Texas Inst., Inc., Dallas, Texas, 1967.

VESIAC 17,023 VU

This report presents the results of the analysis of nine long-period noise samples recorded at the Montana LASA between 12 November 1966 and 7 February 1967. This analysis was undertaken to describe the salient characteristics of the long-period noise. Particular attention was given to spectral analysis, coherence among channels, spatial organization, identification of modal content, and identification of noise sources. Results of the analysis of the long-period noise indicates that the noise generally appears to be related to storms and is probably the result of wave activity in the North Atlantic and North Pacific.

BINDER, F. H., Large-Array Signal and Noise Analysis - Special Sci. Rept. No. 13 - Short-Period Noise Coherence Among Subarrays, Contract VT/6707, AF 33(657)-16678, ARPA Order No. 599, Texas Inst., Inc., Dallas, Texas, 1967.

VESIAC 17,126 VU

Much of the analysis of the mantle P-wave noise proposed for this contract depended on the ability to perform coherent processing by treating seismic noise as a compilation of plane waves using the large aperture available at LASA. The subarray outputs should be P-wave-limited, and the large array could be used to dissect the P-wave noise; therefore, it is extremely important to understand the coherence of the subarray outputs. Presented are results of measured 2-channel and multiple coherence, indicating that the subarray outputs generally are moderately coherent below about 1 cps only within the B ring of the subarrays. A study of these coherences suggests that the most reasonable models would give little coherence between A0 and the E and F rings. Comparison of model-study results with measured coherences suggests that a considerable portion (25 percent or more) of the subarray output power is not interpretable as seismic energy.

BINDER, F. H., Large-Array Signal and Noise Analysis, Quarterly Rept. No. 8, 1 April 1968 to 30 June 1968, Contract VT/6707, AF 33(657)-16678, Texas Inst., Inc., Dallas, Texas, 1968

VESIAC 18,517 VU
AD 836 632

This report is a summary of results obtained on Contract AF 33 (657)-16678, LASA Evaluation, during the period 1 April 1968 through 30 June 1968.

BINDER, F. H., Large-Array Signal and Noise Analysis, Final Rept., Contract VT/6707, AF 33(657)-16678, Texas Inst., Inc., Dallas, Texas, 1968

VESIAC 19,276 VU
AD 846 551

Large-Array Signal and Noise Analysis, Contract AF 33(657)-16678, has been a 2-year study of seismic signals and noise recorded at the Large-Aperture Seismic Array (LASA) in Montana. The findings of this program are summarized in this final report. All results have been previously published in 24 special scientific reports. Work performed under the LASA contract can be divided into six major categories: discrimination studies (earthquake vs explosion), short-period noise studies; f-$\bar{k}$ spectra processing and research; long-period noise analysis; long-period signal analysis and extraction studies; and short-period signal analysis and extraction studies.

BINDER, F. H., A Preliminary Study of Techniques for Routine Matched Filtering of Surface Waves, Seismic Array Processing Techniques, Tech. Rept. No. 4, Contract VT/0701, F33657-70C-0100, Texas Inst., Inc., Dallas, Texas, 1970

VESIAC 20,259 VU
AD 870 778

This report discusses the study made on the effectiveness of various matched filters for processing surface waves of events in the Kuriles as recorded at LASA. The correlation coefficients and signal-to-noise improvements are presented for matching waveforms which include master events, a chirp waveform, and waveforms generated from crustal models. Based on the results of this study, procedures are recommended for implementation of large scale matched filtering at the SAAC center.

BINDER, F. H., Seismic Array Processing Techniques, Quarterly Rept. No. 1, 15 July to 15 November 1969, Contract VT/0701, F33657-70C-0100, Texas Inst., Inc., Dallas, Texas, 1969

VESIAC 19,932 VU
AD 862 225

This first quarterly report discusses progress in the categories of adaptive techniques for designing fixed filters off-line, on-line adaptive processing techniques, long-period array data analysis, short-period 37-element array data analysis, High Resolution Wavenumber spectra displays of seismic array data, and suboptimal multichannel digital filters.

VESIAC 20,124 VU
AD 866 172

BINDER, F. H., Seismic Array Processing Techniques, Quarterly Rept. No. 2, 15 November 1969 to 15 February 1970, Contract VT/0701, F33657-70C-0100, Texas Inst., Inc., Dallas, Texas, 1970

This second quarterly report discusses progress and initial results in the categories of adaptive techniques for designing fixed filters off-line, on-line adaptive processing techniques, long-period array data analysis, short-period 37-element array data analysis, High Resolution wavenumber spectra displays of seismic array data, and suboptimal multichannel digital filters.

VESIAC 20,300 VU
AD 870 765

BINDER, F. H., Seismic Array Processing Techniques, Quarterly Rept. No. 3, 15 Feb. to 15 May 1970, Contract VT/0701, F33657-70C-0100, Texas Inst. Inc., Dallas, Texas, 1970

This report discusses work progress and summarizes results obtained. The work categories are: Design of fixed multichannel filters off-line; on-line adaptive processing; long-period array data analysis; short-period TFO array data analysis; and Hi resolution wavenumber spectra displays of seismic array data.

VESIAC 20,425 VU
AD 876 386

BINDER, F. H., Seismic Array Processing Techniques, Final Rept., Contract VT/0701, F33657-70C-0100, Texas Inst., Inc., Dallas, Texas, 1970

Summarized in this report are 1) experience in array processing of seismic data using adaptive algorithms, including present and previous contracts and an extensive bibliography to work done at Texas Instruments on this subject; 2) long-period array-processing work under this contract, which includes long-period signal-separation studies, a study of matched filtering for Rayleigh waves from the Kuriles recorded at LASA, a study of the UBO and TFO long-period noise fields, and a study of the Nepenthe technique for extraction of surface waves; 3) a study of the offline design of multichannel velocity filters for seismic arrays, with tradeoffs among various techniques examined in detail; 4) the noise field and array capabilities at the extended TFO short-period array; 5) some special problems, including an attempt to remove stable structural lines and a new technique for converting multichannel filters specified in the frequency domain back into time operators; 6) the creation of a motion picture of high-resolution wavenumber spectra of seismic-array data; and 7) an appendix containing abstracts of all special technical reports published under this contract.

VESIAC 15,177 VU
AD 803 360

BINDER, F. H., and J. P. BURG, Array Research - Wavenumber Analysis of TFO Long-Noise Sample, Special Rept. No. 17, Contract VT/4053, AF 33(657)-12747, Texas Instr., Inc., Dallas, Texas, 1966.

This report presents some wavenumber spectra of ambient noise recorded at Tonto Forest Observatory which showed exceptional simplicity. The coherent noise showed a very strong peak corresponding to a directional surface-mode wavetrain with frequency of about 0.2 cps, and two strongly concentrated peaks of body-wave energy which were stable over a fair bandwidth.

These peaks in the wavenumber spectrum appear to be related to two strong storms, one in the North Atlantic just off the coast of Newfoundland and the other in the North Pacific, south of the Aleutians.

These wavenumber spectra indicate that body-wave noise can be highly concentrated in f-k space and that large ocean storms may be a significant contributor to body-wave noise.

BINDER, F. H., T. D. LANEY, and T. W. HARLEY, Large-Array Signal and Noise Analysis, Long-Period Signal Waveform Similarity at LASA, Sci. Rept. No. 9, Project VT/6707, Contract AF 33(657)-16678, Texas Inst., Inc., Dallas, Texas, 1967.

VESIAC 16,912 VU
AD 820 578

The similarity of signal waveform for four long-period events across LASA was studied. The analysis technique depended on differences in waveform but not on amplitude differences. Waveform was found to be very similar between subarrays for P- and S- type phases but not as similar for surface waves due to dispersion. One event was used to study the variation of P-wave amplitudes across the array. Variations were less than 2.5 db, which suggests that amplitude equalization may not be necessary prior to multichannel processing of long-period events. Variation of surface-wave azimuth as a function of frequency was studied for one event, and no appreciable variation was observed.

BLANEY, J. I., J. F. DEVANE, S. J., Evaluation of Seismic Instruments and Basic Research on Seismic Wave Propagation, Interim Sci. Rept., Contract AF 19(628)-6067, Boston College, Chestnut Hill, Massachusetts, 1967.

VESIAC 16,741 VU

This report contains a complete description of a portable FM seismic transmitting and receiving system capable of unattended operation. Each seismometer signal is preamplified and conditioned for FM transmission. The receiver recovers the signal and conditions it for recording, either directly or on magnetic tape.

A computer controlled system for the calibration of seismometers is described. The end product is a response curve in terms of both amplitude and phase.

BOCHUM, H. B., H. BERCKHEMER, H. CLOSS, and W. HILLER, "Proposal of a Research Program for a Seismic Station with Modern Equipment," Westfalische Berggewerkschaftskesse, Buchum, Germany, 1964, Contract SD-78.

VESIAC 8017 VU

This report draws up in some detail five problems needing coverage in a complete seismic station, and suggests simply that the problems indicated should give impetus for new instrumentation. The five areas of concern are: 1) Seismicity in central Europe; 2) Microseismic ground disturbance; 3) Seismic surface waves; 4) Seismic body waves; and 5) Distinction of natural and artificial seismic events. The most significant difficulties in each area are explained.

BODNYI, G., A. FABIAN, and B. KOVACS, "Theoretical Considerations in the Design of a Seismic Unit with Magnetic Recording," Geofizikai Kozlemenyek, Vol. 13, No. 4, pp. 423-437, 1964, (Translated from Hungarian), Contract SD-78.

VESIAC 12,444 VU

This paper deals with non-linear distortions of automatic gain control and of FM circuits. A suitable control characteristic and selected electronic components perform essential operations of the control element. A connection exists between the distortion factor, the central range, the circuit constants and, indirectly, the time constants of the AGC. For the FM device, the modulating voltage and the frequency of the modulator are linearly related.

BOKANENKO, L. I., "Checking the Sensitivity of Seismic Recording Channels," Akad. Nauk SSSR, Trudy Inst. Fizik, No. 6, pp. 320-335, 1959. (Translated from Russian), Contract SD-78

VESIAC 13,371 VU

The problem of checking the sensitivity of seismic recording channels from a seismograph system is examined. This can be accomplished by an inertial method through the application of force to the housing of the seismic receiver. As a result of this application of force, the characteristics of the seismograph system are different from the characteristics of the same system in those cases in which the force is applied on the ground. Experimental data confirming the theoretical calculations are presented.

BOLLINGER, G. A., W. STAUDER, Statistical Evaluation of the Focal Mechanism Solution for Thirty-Six 1962 Earthquakes, Contract AF-AFOSR 62-458, St. Louis Univ., St. Louis, Mo., 1965.

VESIAC 10,560 VU
AD 615 621

The S Wave Project for Focal Mechanism Studies underway at St. Louis University has recently completed a study of thirty-six of the larger magnitude earthquakes that occurred during 1962. Well-determined solutions employing a double-couple model were obtained for twenty-three of these shocks and tentative solutions for the remaining thirteen. This study attempts to specify the agreement between the observed data (direction of first motion of the P wave and polarization angle of the S wave) and the theoretical values of these data as implied by the focal mechanism solutions obtained.

BOLT, B. A., T. V. McEVILLY, The Central Californian Large-Scale Seismic Array, Sci. Rept. Annual, Rept. No. 1506-15, AF 49(638)-1506, Univ. of Calif., Berkeley, Calif., 1967.

VESIAC 17,617 VU
AD 665 120

Two lines of research using the Univ. of California telemetered network of seismographs have been developed in 1967. The first is the derivation of focal mechanisms of many small local earthquakes in order to throw light on the regional tectonic stresses. The second is the computation of $dt/d\Delta$ for S waves across the array and its variation with azimuth. Both these studies are providing novel observational results; in neither case has more than a start been made on the theoretical and inferential aspects.

BOLT, B. A. and T. V. MCEVILLY, The Central Californian Large-Scale Seismic Array, Annual Rept., Jan. 1 - Dec. 31, 1968, Rept. No. 1506-18, Contract AF 49(638)-1506, Univ. of Calif., Berkeley, Calif., 1968

VESIAC 19,307 VU
AD 683 751

General lines of research have depended heavily on the U. C. network in the last year. Properties of S waves from local earthquakes have received special attention. A systematic study of regional tectonics using precise determinations of the seismicity and first-motion P polarities has been completed.

Crustal structure within the area has received further study and a study of aftershocks and "collapses" which are recorded on the Berkeley network stations, particularly Jamestown, following atomic detonations in Nevada was started.

BOLT, B. A., T. V. MC EVILLY, A. BRUCE, and C. LOMNITZ, Research on the Central Californian Large-Scale Seismic Array, Semiannual Tech. Summ. Rept., January - May 1965, Contract AF 49(638)-1506, Univ. of Calif., Berkeley, Calif., 1965.

VESIAC 11,336 VU

This report is entitled "Research on the Central California Large-Scale Seismic Array." Included are: background and objectives of the Contract; technical status; research completed; local seismicity; a discussion of the proposed Mendocino off-shore seismic experiment. Three papers are included under "research completed": they concern the Central California Large-Scale Array; the invariances of the magnitude-frequency relation and simulation of the California earthquake sequences by Monte Carlo Methods; calibration of the World-Wide Station seismometers, BKS-LP. Concerning these seismometers, an "earthquake alarm" is discussed.

BOLT, B. A., T. V. MCEVILLY, and C. LOMNITZ, Research on the Central Californian Large-Scale Seismic Array, Semiannual Tech. Summ. Rept., Rept. No. 1506-11, Contract AF 49(638)-1506, University of California, Berkeley, Calif., 1966.

VESIAC 15,539 VU
AD 647 554

A ten station telemetric network was operated during 1965-1966. The array is 240 km long (priest Valley to Berkeley) and 160 km wide (Granite Creek to Jamestown). The network has allowed high-quality simultaneous recording of seismic signals on film and magnetic tape. A study of the morphology of earthquakes in central and northern California has been carried out, and is discussed. Also, three earthquake sequences associated with main shocks of magnitude 5 and greater have been analyzed. Work has been done on the propagation of P, pP, and PKP waves from teleseisms across the array.

BOLT, B. A., T. V. MC EVILLY, and C. LOMNITZ, Research on the Central Californian Large-Scale Seismic Array, Semi-Annual Tech. Summ. Rept. for December 1965 to May 1966, Rept. No. 1506-8, Contract AF 49(638)-1506, Univ. of Calif., Berkeley, Calif., 1966.

VESIAC 14,628 VU

This report discusses progress made in seismic data processing and in studies concerned with P, S, and surface waves; microearthquakes and aftershocks; and crustal structure.

BOLT, B. A. and T. TURCOTTE, Computer Location of Local Earthquakes within the Berkeley Seismographic Network, Contract No. AF 49(638)-904, Univ. of Calif., Berkeley, Calif., 1963.

VESIAC 5496 VU
AD 439 072

The Berkeley seismograph network described here, allows at present a much more precise determination of the position and origin-time of earthquakes within the region of central and northern California than previously possible. Measurements of the main recorded seismic phases are placed by station staff directly onto Hollerith format sheets. A program which has been coded for an IBM 7090 which sorts out the travel-times from a provisional earthquake focus to each station for the main recorded phases is discussed. Calibration of the location method has been made using observed arrival-times from nineteen quarry blasts and underwater explosions.

BOLT, B. A., T. TURCETTE, S. UDIAS and M. BLACKFORD, A Study of Focal Mechanism and Aftershock Characteristics of Small Earthquakes, Semiannual Tech. Summ. Rept., Contr. No. AF 49(638)-904, Univ. of Calif., Los Angeles, Calif., 1964.

VESIAC 8597 VU

This report includes a general outline of the main activities of station personnel associated with the project and the main innovations in the project during the time considered. Subsequent sections are technical summaries of these specific phases of the study: Telemeter Network, Northern California Seismicity, Quarry Blasts, Local Earthquakes and Sequences, Statistics of Occurrence and Focal Mechanism, and The Network as an Array.

BONCHKOVSKII, V. F., "Deformation of the Earth's Crust Under the Influence of External Forces," Doklady Akad. Nauk, SSSR, Vol. 60, No. 6, pp. 981-984, 1948. (Translated from Russian), Contract DA 49-083 OSA-3137.

VESIAC 17,313 VU

From preliminary data the author undertakes a study of the relationship between tilt and atmospheric pressure resulting from concrete observations of both these phenomena and to make a decision concerning the magnitudes of the moduli of rigidity of these layers which are subject to dip. On the basis of the modulus of rigidity, it is not difficult to determine the actual elastic deformations of the earth's surface.

BONCHKOVSKII, V. F., "A Method for the Determination of the Velocity of Transverse Surface Waves for Constructing Dispersion Curves," Izv. Akad. Nauk SSSR, Ser, Geogr. i. Geofiz., No. 24, pp. 345-350, 1941, (Translated from Russian), Contract SD-78.

VESIAC 12,336 VU

A graphic method is described for calculating the velocities of propagation of seismic surface waves. This method is used in studying the seismograms of earthquakes resulting in dispersion curves characterizing the differences in the thickness of the earth's crust under plane and mountainous terrain.

BONCHKOVSKII, V. F., "Some Generalizations of the Results of Observations of Inclinations of the Earth's Surface," Trudy Inst. Fiziki Zemli, Akad. Nauk, SSSR, No. 7, pp. 3-60, 1959, (Translated from Russian), Contract DA 49-083 OSA-3137.

VESIAC 15,718 VU

This is a monograph on tilting of the earth's surface developed on the basis of earlier papers by Bonchkovskiy and others. Various systems of tiltmeters are described and discussed. Thermal tilting, daily and annual variations, variations with atmospheric pressure, and secular tilts are analyzed. The correlation between earthquakes and volcanism is studied. An example of application of tiltmetering is given where the front of burning coal in underground gasification is followed.

BONDARENKO, A. P., "Data on the Causes of the Earth's Currents," Akad. Nauk, SSSR Izv. Ser. Geograf. i. Geofiz., Vol. 15, No. 1, pp. 40-42, 1951, (Translated from Russian), Contract SD-78.

VESIAC 12,051 VU

The diurnal variations of earth currents are studies on the basis of observations carried out in July and August 1939 and in September 1940 in the region of the Kremenchugsk magnetic anomaly and at the village of Pisarevki (Ukraine). The results of harmonic analysis of the daily mean variations of earth currents are compared with the corresponding elements of the variation of the magnetic field of the earth.

BONNER, J. A., Ambient Noise Analysis of 3-Component Short-Period Data Recorded at Tonto Forest Seismological Observatory, Array Research Special Rept. No. 18, Contract VT/4053, AF 33(657)-12747, Texas Instruments, Inc., Dallas, Texas, 1966.

VESIAC 15,313 VU
AD 805 759

This special report presents the results of a study of 3-component, S-P ambient seismic noise recorded on the extended array at TFO between 27 August and 1 September 1965. The object of the study is the evaluation of ambient noise characteristics to determine whether substantial ambient noise variations (particularly in the trapped-mode components) exist across the extended array. The extent of such variations bears directly on the potential contribution of very-large-aperture S-P seismometer arrays to the nuclear blast detection and classification problem. Analysis procedures and objectives are given, and conclusions. Appendices on power density spectra and frequency filtering are provided.

BOOKER, A. H., Analysis of Variance as a Method for Seismic Signal Detection, SDL Rept. No. 116, Project VT/2037, AF 33(657)-12447, United ElectroDynamics, Inc., Teledyne, Inc., Alexandria, Va., 1965.

VESIAC 9962 VU
AD 457 823

The analysis of variance is examined as a method of automatic signal detection. The method is applicable only to array data and the basic assumption is that after filtering, signals across recording channels will be very similar as compared to the background noise. The output trace is a detection criterion and each point can be translated into a probability that a specific segment of the original array data contains a signal. The results indicate that the method can be used on-line to eliminate noise without discarding signals which would be detected by a trained observer.

BOOKER, A. H., Estimation of Network Capability, Contr. No. VT/2037, AF 33(657)-12447, United ElectroDynamics, Inc., Pasadena, Calif., 1964.

VESIAC 7568 VU

The purpose of this report is to describe a general computer program which was developed to evaluate the capability of various networks of seismograph stations to detect earthquakes or nuclear explosions. Application, limitations, and recommended refinements of the program are discussed. The primary input information is: 1) number, locations, and characteristics of stations; 2) measured or assumed station noise distribution; 3) signal amplitude variation with distance and magnitude; 4) representative sample of epicenter locations. The output information is: a) estimated network and station capabilities; b) estimates of the number of detected events; c) repetition of a and b for selected subsets of the set of stations or of selected epicenter locations.

BOOKER, A. H., Numerical Evaluation of Symmetric Polynomials, Contract VT/2037, AF 33(657)-7427, United ElectroDynamics, Inc., Pasadena, Calif., 1964.

VESIAC 7485 VU

An algorithm is developed for representing the elementary symmetric functions in terms of a family of symmetric functions which are easier for numerical evaluation than the elementary symmetric functions. As an application of the result, the problem of determining the probability of at least alpha of N independent event probabilities is considered.

BOOKER, A. H., M. M. BACKUS, Array Research Preliminary Report Matrix-Multiply Detection Processing of Array Data, Special Report No. 8, Contract AF 33(657)-12747, Texas Instruments Inc., Dallas, Texas, 1965.

VESIAC 12,911 VU
AD 626 408

Described is probabilistic processing—a method of processing the output data of an array of seismometers with the aim of detecting earthquake or underground nuclear blast signals in the presence of ambient seismic noise.

BOOKER, A. H., R. J. HOLYER, Prediction Error and Adaptive Maximum-Likelihood Processing - Advanced Array Research, Spec. Rept. No. 10, Project VT/7701, Contract F33657-67C-0708, Texas Inst. Inc., Dallas, Texas, 1968.

VESIAC 18,066 VU
AD 832 007

Adaptive multichannel prediction error filtering is compared to conventional optimum Wiener filtering for 10 types of array data. Adaptive maximum-likelihood signal extraction is compared to Wiener filtering for three sets of data; the three sets are composed of actual signal, artificial signal with varying magnitude and velocity, and a composite of noise data. Comparison of the two methods is based on total mean-square-error and the distribution of the error power with frequency.

BOOKER, A. H. and W. MITRONOVAS, Power Spectral Density, Energy and Cross-Spectra Determination, Contr. No. VT/2037, AF 33(657)-7427, United ElectroDynamics, Inc., Pasadena, Calif., 1962.

VESIAC 7993 VU

A short description is given of an analog and a digital method of computing power spectral density (PSD). These methods are applied to common data and the results are presented. A comparison of the methods is made and the effects of parameter variation are noted.

BOOKER, A. H. and C. Y. ONG, Effects of Oversampling on Time-Adaptive Filters, Special Rept. No. 1, Advanced Array Research, Contract VT/7701, F33657-68C-0867, Texas Inst., Inc., Dallas, Texas, 1968

VESIAC 19,396 VU

Independent time series data, consisting of white noise with different degrees of oversampling, have been used to study the effect of oversampling on the time-adaptive prediction filter. If the data are oversampled, false gain occurs in the adaptive prediction results. The false gain depends on the degree of oversampling, the number of channels used in making the prediction, the filter length, and the convergence parameter.

Two adaptive algorithms—one having a constant convergence parameter and the other having a variable convergence parameter - are discussed in this report. Particular cases of the prediction mean-square-error function of the time-adaptive filter are derived and compared to the empirical results. Although the false gain can be quite severe for high rates of adaption, rates of adaption can be selected in terms of theoretical maximum rates of adaption so that the false gain is not significant—even for oversampled data cut at 1/20 of the folding frequency.

BOOKER, A. H. and C. Y. ONG, Multiple-Constraint Adaptive Filtering, Advanced Array Research Special Rept. No. 3, Contract VT/7701, F33657-68C-0867, Texas Inst., Inc., Dallas, Texas, 1969

VESIAC 19,753 VU
AD 855 398

The principle of processing multichannel data to minimize noise and yet pass a theoretical deterministic signal with no distortion has been used extensively in the past. This report contains a generalization of this constraint method so that many deterministic signals can be considered simultaneously.

An adaptive method for designing the optimum noise-rejection multichannel filter is described; this method preserves the initially specified desired response of the filter to each of the deterministic signals. A sample of vertical-array data containing a signal is used to illustrate the procedure.

The effect of initial filter response on noise rejection, the apparent time necessary to adapt, and actual signal distortion are some of the topics discussed in detail.

BOOKER, A. H., C. Y. ONG, T. E. BARNARD, and T. KRILE, Theoretical Considerations in Adaptive Processing—Advanced Array Research, Special Rept. No. 13, Contract VT/7701, F33657-67C-0708, Texas Inst., Inc., Dallas, Texas, 1968.

VESIAC 18,065 VU
AD 832 970

Theoretical results on four logically independent problems arising in the application of adaptive multichannel processing are presented. Areas treated are multiconstraint adaptive maximum-likelihood methods, interaction of oversampling with rate of adaption, effect of local noise on multichannel filter design, and adaptive computation of high-resolution wavenumber spectra. Some theoretical questions on uniqueness of the adaptive maximum-likelihood method are considered, and the method is extended to multiple constraints.

BORCHERDT, C. A., R. P. MEYER, and J. R. VAN SCHAACK, PROJECT EARLY RISE - Shot Locations, Technical Letter, NCER-3, Contract: ARPA Order No. 292, U. S. Geological Survey, Menlo Park, Calif., 1967.

VESIAC 16,357 VU

This report summarizes the times and locations of Project EARLY RISE shots of July 1966, and the procedures used to determine them.

BORCHERDT, C. A., J. C. ROLLER, Preliminary Interpretation of a Seismic-Refraction Profile across the Large Aperture Seismic Array, Montana, Tech. Letter No. 2, Contract ARPA Order No. 923, U. S. Geological Survey, Menlo Park, Calif., 1967.

VESIAC 16,380 VU

A reversed seismic-refraction profile extending northeastward from Greycliff, Montana, across the LASA to Charleson, North Dakota, indicates that the crust of the earth consists of two layers with P-wave velocities of 6.1 km/sec and 6.7 km/sec, and that the upper-mantle velocity is 8.3 km/sec. The Mohorovicic discontinuity is 50-km deep at Charleson and remains at nearly the same depth southwestward for a distance of about 300 km, from where it slopes upward to the southwest at about 2° to a depth of 41 km near Greycliff.

BORCHERDT, R. D., Fast Fourier Analysis of Real Data, Using Share Program 3425, Tech. Letter No. 5, Contract: Agency Document, U. S. Geological Survey, Menlo Park, California, 1967.

VESIAC 16,742 VU

This paper describes a subroutine called REALAN which was written to simplify the use of the HARM subroutine (a subroutine written to perform harmonic analysis using three-dimensional complex data) for the case of one dimensional real data. Using REALAN to determine the coefficients of a real finite Fourier series will cut the amount of computing time approximately in half.

BORISEVICH, E. S., With the Seismologists of the United States, (Translated from Russian), USSR, Contract SD-78, 1965.

VESIAC 9297 VU

This is a report of a visit to the U. S. by Borisevich and Riznichenko, representatives of the Academy of Sciences, USSR, to: study the theoretical and experimental achievements made by American seismologists and to examine new types of seismic instruments; to discuss the possibilities of effective inspection in carrying out the atomic test agreement. The author discusses the places he inspected, the views of the scientists he met, and the instruments he saw. His visit to the Lamont laboratory resulted in exchange of American and Soviet seismic apparatus.

BOTELLO, R. J., SDL Digital-to-Analog (DAC) System, Sci. Rept. No. 161, Contract VT/6702, AF 33(657)-15919, Teledyne Industries, Inc., Earths Sciences Div., Alexandria, Va., 1966.

VESIAC 14,984 VU
AD 488 836

A digital-to-analog system, designed and built by the Seismic Data Laboratory, is described. The primary purpose of this system is to convert, as rapidly and efficiently as possible, LASA data from its original digitized format to an analog format. Design considerations are restricted to the degree that existing SDL data processing equipment will be utilized to the fullest extent possible. Reasons for selection of the individual sub-units are given, as well as specifications and over-all system capabilities.

BOTT, M. H. P., Crustal Structure of Great Britain, Contr. No. AF 61(052)-733, Univ. of Durham, Durham, England, 1964.

VESIAC 7832 VU
AD 668 206

The transportable array and digital data processing system currently under construction for use in crustal structure seismic work is described in detail.

BOTT, M. and A. L. LUCAS, Crustal Structure of Great Britain, Contr. No. AF 61(052)-733, Univ. of Durham, Durham, England, 1964.

VESIAC 8747 VU

The purpose of this project is to investigate local variations in crustal structure and the effects thereof on the propagation of seismic waves. This is to be done using a transportable array of seismometers, and a digital recording system. This report describes the progress made in the construction of the system which was discussed in some detail in Scientific Report Number 1. The difficulties encountered are specified, and the future programme of work is considered.

BOTT, M., A. L. LUCAS, Crustal Structure of Great Britain, Sci. Rept. 3, Contract AF 61(052)-733, University of Durham, Durham, England, 1965.

VESIAC 10,279 VU
AD 616 093

This report describes the progress made in constructing a transportable seismic array system for use in crustal studies. A review of published work relating to the research aims of this project is included.

BOTT, M. H. P., A. L. LUCAS, Crustal Structure of Great Britain, Administrative Rept. No. 4, Contract AF 61(052)-733, University of Durham, South Road, Durham City, England, 1965.

VESIAC 12,582 VU
AD 467 637

This report describes the construction of the field instrumentation being built under this crustal refraction program and which is near completion. Progress has been slower than expected. It was realized that to put the main recording system into the field before the punched paper tape facility is completed means that the recording system could not be fully tested and evaluated before use. Described is progress with regard to the digital data generated by the analog-to-digital converter and associated logic. The replaying system and other work with instrumentation and future research plans are discussed.

VESIAC 12,533 VU
AD 627 840

BOTT, M. H. P., A. L. LUCAS, Crustal Structure of Great Britain, Sci. Rept. No. 4, Contract AF 61(052)-733, University of Durham, Durham City, England, 1965.

This report describes the present state of this project in which equipment is being built for use in seismic crustal refraction studies. Emphasis is placed on our priority throughout the report period to have the equipment in the field for a series of explosions scheduled for September, 1965.

VESIAC 14,312 VU

BOTT, M. H. P., and A. L. LUCAS, Crustal Structure of Great Britain, Scientific Report No. 5, Contract AF 61(052)-733, Univ. of Durham, Durham City, England, 1966.

Equipment has been built for use in crustal refraction studies. The field use of this equipment in September 1965, and the data processing system using a digital computer are described. Emphasis is placed on our proposals for a large scale experiment in the summer of 1966 on the granite batholith of South West England.

VESIAC 15,023 VU

BOTT, M. H. P., and A. L. LUCAS, Crustal Structure of Great Britain, Scientific Rept. No. 6, Contract AF 61(052)-733, Univ. of Durham, Durham City, England, 1966.

The hardware built for crustal refraction studies is summarized, the field tests evaluated, and the future field program described.

VESIAC 19,933 VU

BOUCHER, G. and E. F. HOMOUTH, Report on Earth Strains Associated with the Underground Nuclear Explosion Jorum, Recorded at Round Mt., Nevada, Tech. Rept., Contract AF-AFOSR 1820-69, Univ. of Nevada, Reno, Nevada, 1969

During the summer of 1969 the Seismological Laboratory of the University of Nevada constructed a 3-component quartz-rod type strainmeter in a mine tunnel near Round Mountain, Nevada. The Round Mountain mine not only provides a suitable environment for such instrumentation, but it is strategically located within an area bounded by the active earthquake zone of central Nevada, the Nevada Test Site (NTS), and the Supplementary Test Site (STS) in Hot Creek Valley, Nevada. This report describes the strainmeter installation and the results of measurement of the earth strains associated with the September 16, 1969 underground nuclear explosion JORUM at the NTS. A residual strain step of about 5.6×10^{-9} was observed at a distance of 165 km. The striking features of this strain step are that it was in the sense of ground extension, and that it did not decay within at least the first hour after the explosion.

VESIAC 20,288 VU
AD 690 958

BOUCHER, G., S. D. MALONE, and E. F. HOMUTH, Strain Effects of Nuclear Explosions in Nevada, Final Rept., Contract AF-AFOSR 1820-69, Univ. of Nevada, Reno, Nevada, 1970

The University of Nevada's 3 component quartz-rod strainmeter installation at Round Mountain, Nevada (38° 42.1' N, 117° 04.6' W) has recorded a number of underground nuclear explosions at the

Nevada Test Site, beginning with the megaton-sized JORUM event September 16, 1969. That explosion, and the larger HANDLEY event on March 26, 1970 both produced static strain offsets of a few parts in 10^9 at Round Mountain. These offsets did not decay within the first few hours after the explosions.

BOUCHER, G., A. RYALL, and A. E. JONES, Triggering of Earthquakes by Underground Nuclear Explosions, Contract AF-AFOSR 646-66, Univ. of Nevada, Reno, Nevada, 1969

VESIAC 19,393 VU

This paper presents the results of a search of records of the University of Nevada seismographic station network, for grossly observable effects of underground nuclear tests on regional seismicity. Most of the data were obtained at the Tonopah station, 100-150 km from the explosions studied. Periods of time before and after 21 explosions were examined. In all cases of explosions with magnitude $m_b \geq 5.0$, an increase in seismicity was observed for at least one day following the test. The decay of postshot activity and its relationships to the equivalent magnitude of the explosion provide confirmation of the determinative role of the nuclear event. For the most part, this activity was confined to the test site, and was probably located within 20 km of the shotpoint. In one case, however, triggered activity following the FAULTLESS test in January, 1968, appears to have extended to 40 km from the site of the explosion, and one or two of the earlier tests studied may have influenced seismicity at larger distances. Most of the events studied had very small magnitudes, and all earthquakes related to underground tests had magnitudes lower, by at least one magnitude unit, than those of the associated blasts. Attempts to determine the extent to which underground tests influence seismicity in active areas distant from the test site have indicated that, if such effects exist, they are probably minor compared with normal variations in seismicity.

BOYD, T., A. CHILD, and B. R. PEEK, Seismic Noise Survey - Long-Range Seismic Measurements Program, Volume 3, Tech. Rept. No. 66-58, Contract VT/6703, AF 33(657)-16270, Teledyne Industries, Inc., Geotech Div., Garland, Texas, 1966.

VESIAC 14,817 VU
AD 487 224

This report is the third in a series of studies to evaluate the noise levels of LRSM sites. Data from the short- and L-P vertical systems from 26 sites are reviewed, and standardized data compilation methods are discussed. Percentage of occurrence curves and noise spectrum curves are developed for each site studied.

BRABB, E. E., Technical Letter: Earthquake Investigations—1 Chittenden, California Earthquake of September 14, 1963, Contract VT/2035, U. S. Geological Survey, Denver, Colorado, Undated. (OFFICIAL USE ONLY)

VESIAC 7964 VU O

BRADFORD, J. C., Evaluation of TFSO 31 Element Array, Contract VT/2037, AF 33(657)-12447, United ElectroDynamics, Inc., Pasadena, Calif., 1963 (OFFICIAL USE ONLY).

VESIAC 7614 VU O
AD 432 434

BRADFORD, J. C., Weather-Seismic-Noise Correlation Study, Semiannual Rept., 1 December 1961 to 31 May 1962, Contract AF 19(628)-230, United ElectroDynamics, Inc., Pasadena, Calif., 1962.

VESIAC 9529 VU

This is a preliminary report on a program of research directed toward establishing correlation between seismic noise in the period range 0.5 to 2 sec with meteorological conditions. The two ways used in establishing this correlation are described. The sources of the seismic data and the weather data are given. The first three months of statistical work suggest a large number of relationships. The important weather effects are discussed. Six months of analysis remained at the time of the report, and several new sources of data were to be added.

BRADFORD, J. C., Weather-Seismic-Noise Correlation Study, Semiannual Rept. No. 1, Contract No. AF 19(628)-230, United ElectroDynamics, Inc., Pasadena, Calif., 1963.

VESIAC 7102 VU
AD 426 506

The optimal design of seismic arrays and the optimal processing of the data therefrom requires knowledge of the cross power spectra of the noise between pairs of seismometers within the array. The usual practice for obtaining these cross spectra begins by assuming a model for the seismic noise. It is shown that relatively simple source patterns of seismic noise may produce noise traces that are apparently random in nature. Simple experiments designed to gain further insight into the nature of wind generated seismic noise show some promise of developing improved noise models.

BRADFORD, J. C., L. D. ENOCHSON, and G. P. THRALL, Seismic Partial Coherency Study, Rept. No. 624, Contract VT/2037, AF 33(657)-12447, United ElectroDynamics, Inc., 1965.

VESIAC 10,677 VU

The necessity of employing partial coherence functions when a multi-single output linear program is involved is shown in this report. Two noise traces were randomly selected from available Data Lab sources and were combined in various ways to obtain two correlated input traces and an output trace. Gain factors and coherence functions were computed in two ways. Results show the biased answers obtained when only the single input and output are considered. Procedures were also extended to a three input-single output system where the third output was ignored.

BRADFORD, J. C., R. H. SHUMWAY and J. N. GRIFFIN, Weather-Seismic-Noise Correlation Study, Final Report, Contract No. AF 19(628)-230, United ElectroDynamics, Inc., Pasadena, Calif., 1964.

VESIAC 8407 VU
AD 444 069

An analysis program was initiated in December of 1961 to establish correlations of meteorological conditions with seismic noise in the 0.5 to 2 seconds period range. Discussed here are: the sources of the recordings which provided the seismic and meteorological data to be correlated; where the recordings were made; when the recordings were made; and the centrally-located and roving stations in each area where the recordings were made. The recording processing techniques are described. The author describes how the correlation of this data was approached primarily from a statistical (rather than physical) viewpoint. He also describes an exponential model developed which predicted 60% to 90% of the variation in hourly-average noise amplitude.

BRADLEY, E. A., A Study of the Seismicity of the Cincinnati Arch, Annual Rept., Contract No. AF-AFOSR 456-62, Xavier Univ., Cincinnati, Ohio, 1964.

VESIAC 8402 VU

During the past year, the author's study of the seismicity of Ohio, Kentucky, and Indiana has been devoted to two somewhat different programs, progress on both of which is described in this report: 1) Much time and effort was consumed with a preparation of an earthquake history of Ohio from 1876 to the present; and 2) the other phase of the work has been a study of the short-period records from the Milford stations with a view to determining the extent of local seismic activity. In their work thus far, the author has been fortunate to have obtained excellent cooperation from the various quarries in Ohio, Kentucky, and Indiana. Future plans are mentioned: the author has received a two-year continuation of the grant to study the seismicity of the area.

BRADLEY, E. A., S. J., R. B. HERRMANN, A Study of the Seismicity of the Cincinnati Arch, Final Rept., Contract AF-AFOSR-677-64, Xavier Univ., Cincinnati, Ohio, 1967.

VESIAC 16,628 VU

This report summarizes the work done on the evaluation of data on local, crustal velocities and dispersion of surface waves in order to derive a theoretical crustal structure for the Cincinnati Arch.

BRADNER, H., Geophysical Measurements with Sea Floor Instruments, Contract No. AF 49(638)-1388, Univ. of Calif., Los Angeles, Calif., 1964.

VESIAC 8452 VU

Many properties of the ocean floor can only be measured by placing instruments directly on the bottom, three or four miles down. The author describes some recent work in this category, with special emphasis on seismic measurements. The difficulties of deep geophysical prospecting are discussed. A short history of deep-ocean seismic work is included: Maurice Ewing of Columbia University, the work of the Texas Instruments Company and the University of California is mentioned. The Implacement Methods, and the Data Reduction Method are discussed.

BRADNER, H., Inertial Navigation without Gyros, Sci. Rept., Contract AF 49(638)-1388,Univ. of Calif., La Jolla, Calif., 1969

VESIAC 19,280 VU

The horizontal displacement of an object can be determined by multiply integrating the outputs of two ideal accelerometers mounted on a pendulum on the object. The result is independent of the time history of the displacement or tilts. It is also independent of the damping and natural period of the pendulum, provided only that the integration extends from before the displacement occurs, until after the pendulum comes to rest.

BRADNER, H., J. G. DODDS, and R. FOULKS, Investigation of Microseism Sources with Ocean-Bottom Seismometers - Part I, Contract AF 49(638)-1388, GRANT AFOSR 62-420, Univ. of Calif., San Diego, Calif., 1965.

VESIAC 11,827-A VU

Recordings to depths of 5 km have been made on the Pacific Ocean bottom with self-rising internally recording seismometers. Simultaneous recordings have been made at land stations. The ocean-bottom noise spectrum is presented, as well as coherence between two simultaneous instruments separated one-quarter kilometer. Attempts to associate narrow-beam Love and Rayleigh peaks with large storm-generating areas or with heavy swell striking shore have not produced consistent results. The energy is largely carried in different modes at different times and locations. Discussed is how some data fits a model of microseisms generation at a 100 mile strip.

BRADNER, H., F. GILBERT, R. A. HAUBRICH, and W. H. MUNK, Study of Earth Noise on Land and Sea Bottom, Semiannual Tech. Summ. Rept., Contract AF 49(628)-1388, Univ. of Calif., La Jolla, Calif., 1965.

VESIAC 9785 VU

This study is divided into three sections: (1) Ocean-bottom seismic work; (2) Liquid level horizontal accelerometer; and (3) Spectral mapping. The ocean-bottom seismic work described relates only to instrumentation. The spectral analyses of stationary time series here are used to study non-stationary processes. This report shows some results for an earthquake and a nuclear blast.

BRADNER, H., F. GILBERT, R. HAUBRICH, and W. MUNK, Study of Earth Noise on Land and Sea Bottom, Semiannual Tech. Summ. Rept., Contract AF 49(638)-1388, Univ. of Calif., La Jolla, Calif., 1966.

VESIAC 13,965 VU

This paper presents material on a wave-number analysis of seismic noise, viscosity of the earth, propagator matrices in elastic wave and vibration problems, and a study of long-period ocean-bottom seismometers.

BRADNER, H., F. GILBERT, R. HAUBRICH, and W. MUNK, Study of Earth Noise on Land and Sea Bottom, Annual Report, Contract AF 49(638)-1388, Univ. of Calif., San Diego, Calif., 1967.

VESIAC 15,736 VU
AD 810 757L

Several theoretical seismograms and hodographs, for the buried line source problem, are presented to illustrate the effect of gravity on the locked Rayleigh pulse.

The effect of gravity on dispersion curves, for a layer with a rigid bottom, is to distort them in such a way to produce wave groups similar to the classical gravity waves in a fluid layer when the shear speed is small. In addition, there are very slow wave groups with wavelengths shortened by gravity. Several dispersion curves are presented to illustrate these features.

BRADNER, H., F. GILBERT, R. A. HAUBRICH, and W. H. MUNK, Study of Earth Noise on Land and Sea Bottom, Contract AF 49(638)-1388, University of California, La Jolla, California, 1967.

VESIAC 16,733 VU

The five papers presented in this report are: (1) Approximate solutions to the Inverse Normal Mode Problem; (2) Array design; (3) Gyroscopic Seismometer; (4) Diagnostic diagrams and transfer function for oceanic wave-guides; and (5) Head waves from the oceanic Mohorovicic Discontinuity.

BRADNER, H., R. A. HAUBRICH, F. GILBERT, and W. MUNK, Study of Earth Noise on Land and Sea Bottom, Semiannual Tech. Summ. Rept., Contract AF 49(638)-1388, Univ. of Calif., San Diego, Calif., 1965.

VESIAC 11,827 VU

This semi-annual report covers the period through the end of the eleventh month of the contract. This report covers research already completed. It contains four parts: (a) "Investigation of Microseism Sources with Ocean-Bottom Seismometers"; (b) "Note on Product Integrals"; (c) "Matrix Operations in Elastic Wave and Vibration Problems"; and (d) "Stationary and Non-Stationary Ground Movements at Frequencies from 1 to 200 Millicycles per Second."

BRADNER, H., R. A. HAUBRICH and W. H. MUNK, Study of Earth Noise on Land and Sea Bottom, Final Report, Contr. No. AF-AFOSR 420-62, Univ. of Calif., Los Angeles, Calif., 1964.

VESIAC 8743 VU
AD 450 331

The first section of this report deals with statistical properties of microseisms on land. This includes: spectral analysis, stationarity, normality, bispectrum. Microseisms in the band 5-200 mcps and station arrays are also studied. The results indicate that most of the microseismic energy from 100 to 400 mcps propagates in a single mode. The ocean-bottom seismic background spectra between Hawaii and New Zealand are found to be similar to those between Hawaii and Southern California. Many of the ocean-bottom spectra show series of peaks that do not appear on land records. The microseismic background spectra on the ocean floor do not change significantly in an hour's time, but day to day changes may be radical.

BRISCOE, H. W., On-Line Processing and Recording, Contract AF 19(604)-7400, Lincoln Lab., Mass. Inst. Tech., Lexington, Mass., 1965.

VESIAC 13,858-N VU
AD 648 415

The author discusses his concept of the overall processing for data from LASA and summarizes the terminology he will use for various processing techniques. He then goes into the details of the current and proposed on-line processing for LASA.

BRISCOE, H. W., J. CAPON, P. L. FLECK JR., and P. E. GREEN JR., ET AL, Interim Report on Capabilities of the Experimental Large Aperture Seismic Array, Tech. Note 1966-16, Rept. No. TDR-66-47, Contract AF 19(628)-5167, Lincoln Lab., Mass. Inst. Tech., Lexington, Mass., 1966.

VESIAC 14,173 VU
AD 631 285

This report presents an interim appraisal of capabilities of a single Large Aperture Seismic Array system to perform the following functions: (a) preprocess arriving seismic signals to increase their detectability, (b) use such preprocessed signals to perform on-line automatic detection and location, (c) process recordings of LASA data off-line, and (d) use the results of the off-line processing for studies of seismic source type.

BRISCOE, H. W., P. L. FLECK, A Real-Time Computing System for LASA, Rept. No. ESD-TR-66-227, Contract AF 19(628)-5167, Lincoln Lab., Mass. Inst. of Tech., Lexington, Mass., 1966.

VESIAC 15,893 VU
AD 642 202

A large seismic detection system has been constructed in which over 500 remote analog sensors are spread over 10,000 square miles in Montana. A central computer is mandatory to make this system practical and operational. Because many sensors are spread over a very large area, the computer must direct the maintenance by remotely testing each sensor and alert teams to correct malfunctions where they occur. In addition, because the data gathered is large, the central computer must pre-process the data and decide which small fraction is to be saved (e. g., that data which has interesting earthquakes or other seismological events). Both of these tasks are accomplished by processing the analog waveforms with a central digital computer.

BRISCOE, H. W., R. M. SHEPPARD, A Study of the Capability of a LASA to Aid the Identification of a Seismic Source, Tech. Note 1966-38, Rept. No. ESD-TR-66-362, Contract AF 19(628)-5167, Mass. Inst. of Tech., Lincoln Lab., Lexington, Mass., 1966.

VESIAC 14,815 VU
AD 637 283

Several studies have been performed to investigate the ability of a LASA or a network of LASAs to aid in discriminating between explosions and natural earthquakes from observations of the seismic waves they generate. The major effort has been an attempt to relate the ability to observe the pP phase, first motion, and complexity of an event to the well-documented ability of LASA to improve SNR. Results indicate that the ability to see first motion varies directly with SNR, but that the ability to identify pP is apparently improved more than the SNR gain would indicate, probably due to the ability of a large array to measure velocity directly.

BROCKAMP, B., and I. W. MUNSTER, "Seismic Studies in Ice," Ztschr. f. Geophys., Vol. 23, pp. 241-249, 1957, (Translated from German), Contract SD-78.

VESIAC 9819 VU

Velocity measurements of longitudinal sound waves in ice rods are reported as a function of temperature and positive pressure.

The investigations showed that a slight increase of velocity exists with decreasing temperature and increasing positive pressure.

BRODING, R. A., S. D. BUCHANAN and D. P. HEARN, The Use of the Earth as an Electroseismic Transducer, Contract No. AF 49(638)-1085, Century Geophysical Corp., Tulsa, Oklahoma, 1963.

VESIAC 6293 VU

Electrical signals generated in the earth as a result of seismic energy were investigated as a possible means of detecting low frequency seismic events. It was found that the electroseismicity of the earth was highly variable and inefficient. For detection of small seismic signals, the method could not be recommended over seismic detection methods involving use of conventional inertial seismometers. For strong motion measurements, under certain conditions, the method should be considered.

BROOME, P. W. and W. C. DEAN, Seismological Applications of Orthogonal Function Expansions, Final Report, Contract No. AF 49(638)-1117, United ElectroDynamics, Inc., Pasadena, Calif., 1964.

VESIAC 8385 VU
AD 443 977

A method is presented to represent very complicated transients by only a few numbers rather than by curves or by the set of coordinate values necessary to draw curves. In addition, two sets of procedures are developed, one which is exact for analog computations, and one which is exact for numerical calculations. Section II of the report is concerned with sets of continuous orthogonal functions and is oriented toward analog computations. Section III is devoted to developing sets of orthogonal sequences. Finally, special emphasis is placed on the class of transients called teleseismic P waves. Various examples are shown in Section IV using real data.

BROOME, P. W., F. A. KLAPPENBERGER, and D. E. FRANKOWSKI, Amplitude Anomalies at LASA, Contract AF 19(628)-5167, Teledyne Indust., Inc., Earth Sci. Div., Alexandria, Va., 1967.

VESIAC 16,651 VU

Average amplitude anomalies are presented as functions of source region. Data from approximately 300 events were used in this analysis.

BROSSE, P., "Seismic Determination of the Water Table," Ztschr. f Geophys., Vol. 23, pp. 236-240, 1957, (Translated from German), Contract SD-78.

VESIAC 9820 VU

On the occasion of a seismic survey in a petroleum concession in the Upper Rhine Valley graben, at more than 400 test points, the water table was calculated from the seismically determined uphole time and the drilling depth. From the condition of the ground-water level conclusions can be drawn concerning the presence and the course of ground-water currents.

BROWN, J. E., J. P. BURG, and A. H. BOOKER, Study of a 1-Point Adaptive Filter - Advanced Array Research, Special Rept. No. 4, Project VT/7701, Contract F33657-67C-0708, Texas Inst., Inc., Dallas, Texas, 1967.

VESIAC 17,425 VU

This report describes a filtering system which can adjust to changes in either signal or noise, thereby overcoming many difficulties of time-invariant filtering. The small amount of required computational time to update the filter weights is another important feature of the scheme presented.

An adaption algorithm applied to a simple time-series model was studied. For the case of stationary data, a tradeoff between the adaption rate and the mean-square-error performance of the filter exists. For the case of nonstationary data, a tradeoff between adapting too slowly and adapting too rapidly exists. The optimum rate of adaption appears to be approximately 10 times faster than the average time rate of change in the input data statistics.

BROWN, R. F., Dual-Galvanometer Seismograph, Contr. No. VT/072, AF 33(657)-9967, Geotechnical Corp., Garland, Texas, 1964.

VESIAC 7807 VU
AD 439 363

The presence of high-amplitude microseismic noise with periods of 4 to 8 sec is a problem to seismologists. The summed output of long- and short-period phototube amplifiers (PTA's) driven by a single seismometer can provide a response with a notch, substantially reducing this noise. A seismometer whose period can be easily adjusted in this range is used, since the position of the notch is controlled primarily by the period of the seismometer. The short- and long-period PTA's contain, respectively, galvanometers with a 0.2 and a 110-sec period. The best response is obtained by setting the period of the seismometer the same as the microseismic noise and adjusting the gain of the two PTA's to be equal at this period. Laboratory tests agree with those predicted by theoretical analysis.

BROWN, T. G., Design and Installation of a Borehole with Compliant Casing - Tech. Rept. No. 66-65, Contract VT/5081, AF 33(657)-15288, Teledyne Industr., Geotech. Div., Garland, Texas, 1966.

VESIAC 14,625-A VU

A shallow hole was drilled to a depth of 150 ft in the Wichita granite at Wichita Mountains Seismological Observatory (WMSO). Steel casing was installed in the hole except for the interval from 65 ft to 115 ft throughout which compliant polyvinyl chloride (PVC) plastic casing was used to provide an environment appropriate to the installation of a vertical strain seismometer. Rigid standards of deviation and alignment were adhered to, resulting in hole deviation of less than 1/3 degree from the vertical and 1/2 in. maximum horizontal displacement of the center of the PVC casing throughout the critical depth interval from 60 ft to 120 ft. The cased hole was completed with an unrestricted inside diameter of 7-5/8 in. to a depth of 127 ft on April 15, 1966.

BROWN, T. G., J. M. POORT, Subsurface Studies and Shallow-Hole Preparation: LASA Area, Eastern Montana, Tech. Rept. No. TR 65-21, Contract VT/4051, AF 33(657)-12145, Geotechnical Corp., Garland, Texas, 1965.

VESIAC 17,615 VU
AD 822 626

Six shallow holes were drilled in the Miles City area of eastern Montana. Lithology, velocity, and density information were obtained from logs conducted during the drilling operations. These data, together with existing geological information on the area, were used to perform subsurface geological studies.

The studies indicate that the central LASA region is situated on approximately 3200 m of undisturbed sediments lying comformably on Precambrian basement rocks. Some structural deformation exists at the east and west extremities of the region. P-wave velocities average less than 3km/sec in Mesozoic sediments to depths on the order of 1900 m, and average about 5.8 km/sec in Paleozoic rocks below that depth.

BRUMBACH, R. P., Digital Computer Routines for Power Spectral Analysis, Tech. Rept., Rept. No. TR 68-31, Contract Nonr 4298(00), General Motors Corp., Santa Barbara, Calif., 1968

VESIAC 18,654 VU

This report presents FORTRAN IV source program listings for 8 routines of general use in power spectral density analyses on a digital computer. Included are a Fast Fourier Transform routine, power density function routine via the FFT, and data massaging routines. Mathematical derivations and manipulative techniques of deterministic spectral analysis theory for sampled data are set forth in detail.

BRUMBACH, R. P., Note on the Source Location Problem, Tech. Rept., Rept. No. TR 66-82, Contract Nonr-4298(00), General Motors Corp., Santa Barbara, Calif., 1966.

VESIAC 15,315 VU
AD 645 614

This report contains a detailed, though not mathematically rigorous, discussion of the source location problem and its least squares solution for ray theoretic models. The deviation falls out quite naturally in a covariant form for spaces of arbitrary dimension. The presentation has been influenced by the presumption that numerical calculations will be carried out on a high-speed digital computer. No new results are presented; the note is intended to be of a didactic nature.

BRUNE, J. N., and C. R. ALLEN, A Micro-Earthquake Survey of the San Andreas Fault System in Southern California, Contract AF 49(638)-1337, Calif. Inst. of Tech., Pasadena, Calif., 1966.

VESIAC 15,191 VU

Micro-earthquakes have been recorded with magnitudes down to -1.3 at more than 60 sites along the San Andreas Fault in southern California during intervals of 2 days to 1 year, representing more than 35,000 hours of usable records. Eight trailer-mounted instruments were operated with peak gains of 4-8 million at 20 cps with noise levels averaging about 0.1 mu amplitude of ground motion. Observed micro-earthquake activity varies virtually nil along the central section of the Fault to more than 75 shocks daily in the Imperial Valley. Quietest is the 300 km segment between Cholame and Valyermo; more than 1 year of recording at Lake Hughes indicates an average of only 1 micro-earthquake within 24 km every 9 days. Activity of various kinds up and down the Fault are described.

BUNGUM, H., L. BRUL[illegible], and E. RYGG, Seismic Noise Structure at the Norwegian Seismic Array, Sci. Interim Rept., Rept. No. 3, Contract F61052-68C-[illegible], University of Bergen, Seis. Inst., Bergen, Norway, 1969

VESIAC 20,122 VU
AD 702 825

Power spectral analysis in frequency-wavenumber space and coherence studies in lag space have shown that the noise recorded by the short period 12 sensor Over subarray at NORSAR is critically dependent on the weather situation in the North Atlantic Ocean. In addition to the low frequency noise from the west, there is observed 2 second microseisms from the Baltic Sea. Because of the non-isotropic noise, the coherence is usually strongly azimuthal dependent, being represented in lag space by ellipses. Time variations of the coherence by a factor of 5 are easily observed.

BURG, J. P., Spatial Characteristics of Ambient Short-Period Seismic Noise, Contract No. ARPA Agency Document, Texas Inst., Inc., Dallas, Texas, 1963 (OFFICIAL USE ONLY).

VESIAC 7351 D VU O

BURG, J. P. and M. BACKUS, Array Research Basic Theory of Probabilistic Processing, Special Report No. 4, AF 33(657)-12747, VT/4053, Texas Instruments, Dallas, Texas, 1964.

VESIAC 9440 VU
AD 454 597

This report's goal and that of later reports is to investigate the desirability of using probabilistic processing on an array of seismometers with the aim of detecting earthquake or underground nuclear blast signals in the presence of ambient seismic noise.

This report narrows itself down to the processing of Gaussian multichannel stationary time series.

The first section deals with the basic theory of probabilistic processing theory.

In Section II, the theory of probabilistic processing is applied to variations of a single-channel detection problem with the aim of illustrating the nature of probabilistic processing.

Section III contains the derivation of a practical analog technique for implementing probabilistic processing on an array of seismometers.

BURG, J. P., A. ALAM, Minimum-Power Array Processing of the TFO Long-Noise Sample, Advanced Array Research, Special Rept. No. 12, Contract VT/7701, F33657-67C-0708, Texas Inst., Inc., Dallas, Texas, 1968.

VESIAC 17,986 VU
AD 829 859

This report investigates the effectiveness of the minimum-power array processing technique in determining seismometer inequalizations. The technique involves partitioning the seismometer array into two groups and designing MCF's for each group so that the mean-square-error between the two MCF outputs is a minimum under the constraint that the output power of one of the MCF's is unity.

BURG, J. P., and G. C. BURRELL, Array Research, Semiannual Tech. Rept. No. 5, 15 November 1965 to 15 May 1966, Contract VT/4053, AF 33(657)-12747, Texas Inst., Inc., Dallas, Texas, 1966

VESIAC 19,320 VU

Project VT/4053 is directed toward continuing the development of array-processing technology for nuclear surveillance and exploitation of the superior data available from arrays for analysis of distant P-waves.

Work during the period covered by this report has included: (1) Preliminary analysis of the ambient noise recorded on the large-aperture, short-period array at TFO and at eight van locations; (2) Prediction of short-period, signal-generated noise compiled from topographic charts using TFO 3-component data; (3) A study of surface-wave noise estimation using horizontal components at TFO; (4) A study of various CPO teleseism ensemble subgroups; (5) A study of partial array capabilities at WMO so estimations of the seismometer

PTA output inequities could be made and to compare the effectiveness of the MCF systems with a summation of 10 seismometers; (6) A study of capabilities at CPO to investigate the effectiveness of small partial arrays; (7) An analysis of UBO road noise so filters can be designed to reject this noise; and (8) The assembly of data libraries from data collected at TFO, UBO and WMO.

BURG, J. P., G. C. BURRELL, Array Research, Analysis of K-Line Wavenumber Spectra from the TFO Long Noise Sample, Special Rept. No. 23, Project VT/4053, Contract AF 33(657)-12747, Texas Instruments, Inc., Dallas, Texas, 1967.

VESIAC 16,062 VU
AD 813 107

This report contains the analysis of 1 - dimensional wavenumber spectra obtained from a 20 - min ambient seismic noise recording at a crossarray. The 1 - dimensional wavenumber spectra presented in this report are physically interpreted as projections of 2 - dimensional power density spectra onto perpendicular axes which are parallel to the two arms of the crossarray at TFO. Thus, these new wavenumber spectra give the power density of the ambient seismic noise as a function of its apparent wavenumber along each of the two arms of the array. Although knowledge of the spectral projections onto two perpendicular lines is basically inferior to knowing the 2 - dimensional spectrum itself, the exceptionally high resolution of these K - line spectra allows a much finer analysis of the TFO long noise sample than could be done before using only the low resolution 2 - dimensional spectra.

BURG, J. P., G. C. BURRELL, J. BONNER, and G. BAKER, et al, Array Research, Semiannual Tech. Report No. 5, 15 November 1965 to 15 May 1966, Contract VT/4053, AF 33(657)-12747, Texas Inst., Inc., Dallas, Texas, 1966.

VESIAC 14,819 VU
AD 487 220

Project VT/4053 is directed toward continuing the development of array-processing technology for nuclear surveillance and exploitation of the superior data available from arrays for analysis of distant P-waves. Work during the period included: (1) Preliminary analysis of the ambient noise recorded on the large-aperture, short-period array at TFO and at eight van locations; (2) Prediction of short-period, signal-generated noise compiled from topographic charts using TFO 3-component data; (3) A study of surface-wave noise estimation; (4) A study of various CPO teleseism ensemble subgroups; (5) A study of partial array capabilities at WMO; (6) A study of capabilities at CPO to investigate the effectiveness of small partial arrays; (7) An analysis of UBO road noise so filters can be designed to reject this noise; (8) The assembly of data libraries.

BURG, J. P., T. J. CRUISE, and A. H. HOOKER, Statistics Governing the Design and Performance of Noise-Prediction Filters, Advanced Array Research, Rept. No. 3, Project VT/7701, Contract F33657-67C-0708, Texas Inst., Inc., Dallas, Texas, 1967.

VESIAC 17,431 VU
AD 826 558

In designing a digital multichannel filter from a limited sample of noise, a highly important parameter, σ, is defined as the true mean-square error of the estimated filter (i. e., the average long-term performance of the filter obtained from the noise sample) divided by the true mean-square error of the optimum filter.

A second similar parameter, β, defined as the estimated mean-square error of the estimated filter (i. e., the regression error) divided by the true mean-square error of the optimum filter is highly useful in deciding the reliability of the apparent effectiveness of the designed filter.

The probability densities of α and β are derived for the Gaussian assumption and graphs useful in experiment design are presented in this report.

BURG, J. P., G. D. HAIR, L. N. HEITING, and A. H. BOOKER, et al., Advanced Array Research, Final Report, Contract VT 7701, F33657-67C-0708, Texas Inst., Inc., Dallas, Texas, 1968.

VESIAC 18,004 VU
AD 830 462

A qualitative summary of the four principal tasks pursued during 1967 is presented.

Principal tasks reported are studies of continuously adaptive data processing systems; use of multicomponent arrays of mixed sensor type; signal and noise characteristics across a worldwide seismic network; and new approaches to the intra-array signal equalization problem.

BURG, J. P., R. J. HOLYER, and A. H. BOOKER, Adaptive Filtering of Seismic Array Data, Advanced Array Research, Spec. Rept. No. 1, Project VT 7701, Contract F33657-67C-0708, Texas Inst., Inc., Dallas, Texas, 1967.

VESIAC 17,015 VU
AD 821 909

Adaptive multichannel prediction filtering has been completed on four data samples, and adaptive maximum-likelihood signal extraction has been done on one sample. Comparison of adaptive results with those obtained from processing the same data with stationary filters (nonchanging filters designed from correlation-function estimates) shows that the adaptive filters approach the stationary filters as k_s (the rate-of-convergence parameter in the adaptive algorithm) approaches 0. For larger values of k_s, adaptive prediction-error filtering does better than stationary filters on non-time-stationary data, but stationary filters are better on data samples which appear to be time-uniform.

BURG, J. P. and C. H. LU, Analysis of the Wichita Mountains Seismological Observatory Ambient Noise Spectral Lines, Advanced Array Research Special Rept. No. 10, Contract VT 7701, F33657-68C-0867, Texas Inst., Inc., Dallas, Texas, 1969.

VESIAC 19,760 VU
AD 855 346

A long sample of Wichita Mountains Seismological Observatory short-period ambient noise is analyzed to determine the source and propagation mode of the energy appearing as narrow lines in the noise spectrum. Rayleigh wave propagation from the northeast is inferred from the study of phase spectra.

A time-domain technique for predicting extremely narrow-line spectral components so that they may be removed by subtraction is demonstrated for a 13-element array. The technique is highly effective and it appears that its use would be most beneficial at stations having narrow spectral lines in the ambient noise at frequencies in the signal band.

BURKE, T. F., Acoustic Phased Arrays for the Detection of Nuclear Bursts in the Atmosphere, Contract SD-79, Rand Corp., Santa Monica, Calif., 1965

VESIAC 19,669 VU
AD 623 679

A discussion of the possible use of phased arrays in detecting the acoustic signal from atmospheric nuclear bursts. This Memorandum considers, for simple unshaded square plane arrays, the dependence of array gain upon frequency, azimuth, size of array, number of sensors in the array, and uncertainty in local velocity of sound. The author concludes that the use of phased arrays of omni-directional acoustic sensors would significantly improve both the signal-to-turbulent-noise ratio and the signal-to-acoustic-noise ratio.

BURKHART, K., "Measurement of the Inclination with the Tilting Coil and Long-Period Galvanometer," Ztschr. f. Geophys., Vol. 23-24, pp. 41-45, 1957-58, (Translated from German), Contract SD-78.

VESIAC 9815 VU

Two methods exist for the inclination measurement with the earth inductor. According to the earlier method, utilized already by Wilh. Weber, the coil is tilted by 180°. A current reversal as in the rotating coil is unnecessary. However, this measurement can only be conducted with a L-P or ballistic galvanometer. Examples of one tilting are calculated according to theory and according to the multiplication method. The period of the galvanometer was assumed to be 5 sec. in both cases.

BURRELL, G. C., Geophysical Comparison of the Aleutian Islands and the Kurile-Kamchatka Area, Contr. No. AF 19(604)-8517, Texas Inst., Inc., Dallas, Texas, 1964.

VESIAC 7762 VU

This summary shows that geologically the Aleutian and Kurile-Kamchatka areas are similar in rock suite, age, and structure. Faulting, however, appears to differ in both magnitude and extent. Seismic activity is similar except that events deeper than 300 km present in the Kuriles are not observed in the Aleutians. Also, epicenters associated with Aleutian events do not extend as great a distance from the island arc as do those of the Kurile events. The Kuriles contain all the principal accurate features listed by Richter (1958). The Aleutians contain all except the inner structural arc containing old or extinct volcanoes and the belt of deep earthquake foci. Magnetic and gravity anomalies are similar in both areas. A comparison chart and bibliography are appended.

BURRELL, G. C., Multiple Array Processor, Special Report on MCF-8 Redesign and Evaluation, Contract VT 5052, AF 33(657)-13901, Texas Instr., Inc., Dallas, Texas, 1966.

VESIAC 14,064 VU

This report describes the synthesis and evaluation of multichannel filters to replace MCF-8 discussed in Texas Instruments Multiple

Array Processor final report. One-percent random noise was added to the noise model during filter design and the signal model was unchanged. The new filter set has been installed and now is operating as MCF-9 at UBO.

BURRELL, G. C., F. H. BINDER, R. B. RODEN, and L. N. HEITING, Array Research, Final Rept., Project VT/4053, Contract AF 33(657)-12747, Texas Instruments, Inc., Dallas, Texas, 1967.

VESIAC 16,080 VU
AD 814 568 L

In this report, work done in the following areas is summarized: (1) Multisensor and Multicomponent studies; (2) Analysis of k-line wavenumber spectra from the TFO long-noise sample; (3) Analysis of 3-component long- and short-period data recorded at TFO; (4) An investigation of methods of separating waves by phase at CPO; and (5) Velocity partitioning at CPO and TFO.

BURRELL, G. C., P. R. LINTZ, Array Research, Array Processing at UBO, Special Report No. 22, Project VT/4053, Contract AF 33(657)-12747, Texas Inst., Inc., Dallas, Texas, 1967.

VESIAC 15,739 VU
AD 809 702

The purpose of this study was to determine the amount of noise that could be predicted at UBO by the use of noise prediction filters. Twenty-two noise prediction filters were developed and evaluated for the surface and subsurface planar arrays at UBO. Results indicated, in part, that below 1.25 cps, the noise field was highly predictable, while above 1.25 cps, the noise field was almost random.

BURRIDGE, R., The Legendre Functions of the Second Kind with Complex Argument in the Theory of Wave Propagation, Publ. No. 440, AF-AFOSR-710-64, Univ. of Calif., Los Angeles, Calif., 1965.

VESIAC 12,580 VU

Implicit in the asymptotic expansion of functions given by Hobson is the fact that they represent traveling waves in spherical structures, while P_n (cos theta) and Q_n (cos theta) represent standing waves. Whereas the exponential function and the Hankel functions are universally exploited for this same reason these Q_n (cos theta plus or minus Oi) have been neglected. It is the aim of this paper to demonstrate that their use leads to a completely natural derivation of ray contributions in problems concerning waves in and about spheres.

BURRIDGE, R., Mode Conversion in a Wave Guide with Slowly Varying Width and Direction as a Perturbation, Publ. No. 442, GRANT AFOSR-710-64, Univ. of Calif., Los Angeles, Calif., 1965.

VESIAC 11,824 VU

In this paper the wave guide is regarded as a slight distortion of one for which the variables in the wave equation separate. The two-dimensional space of the latter wave guide is not flat. The perturbation is applied to the metric to give back the original wave guide in physical space.

BURTMAN, B. S., "The Talas-Fergana Fault and the San Andreas Fault," Akad. Nauk. SSSR, Geol. Inst., No. 80, pp. 128-151, 1963, (Translated from Russian), Contract DA 49-083 OSA-3137.

VESIAC 14,311 VU

In this article, a brief outline of the San Andreas Fault, the best known fault with a large amplitude is given. The San Andreas Fault is compared with the Talas-Fergana Fault in the Tien Shan.

BYBEE, H. H., Suboptical Multichannel Digital Filters, Seismic Array Processing Techniques, Tech. Rept. No. 2, Contract VT/0701, F33657-70C-0100, Texas Inst., Inc., Dallas, Texas, 1970

VESIAC 20,090 VU
AD 865 534

This report discusses a new method of generating time-domain filters to extract a signal from digitized multichannel noise. The new filter generation technique is based on the frequency-domain Wiener filter response and uses the mean-square-error of the whole filter set in the transformation back into the time domain. This new, computationally efficient technique was evaluated against a previously used technique, also based on the frequency-domain Wiener filter response. Two different sets of experimental noise data with power spectra specified at 65 frequencies were used in the filter evaluation, and the signal to be detected was assumed to have the same power spectrum as the noise to prevent frequency filtering. For the first noise sample and 37-point long filters, the previous technique gave 0.8 db more error than the optimum frequency-domain filter and the new filtering technique gave 0.5 db more error. For the second noise sample, these respective filters had 1.2 db and 0.9 db more error than the optimum technique.

BYERLY, P., and B. A. BOLT, A Study of Focal Mechanism and After-shock Characteristics of Small Earthquakes, Final Rept., Contract AF 49(638)-904, Univ. of Calif., Berkeley, Calif. 1965.

VESIAC 9961 VU
AD 458 052

Six permanent and three mobile seismograph stations have been added to the University of California network. Ten of nineteen stations are linked to Berkeley by telephone lines, reporting directly onto 16 mm film signals from short-period Benioff seismometers as well as instruments with a 15-second free period. The network produced an exhaustive record of seismic activity in California's central coast region with emphasis on earthquakes of magnitude of 5 and less. In connection with these quakes, epicenters and mobile station placement are discussed. Also discussed are recalibration of travel-time tables with data from a study of quarry blasts, and four local earthquake sequences.

CABANNES, H., "Theory of Shock Waves," Handbook of Physics, IX, Fluid Mech., pp. 162-224, 1960, (Translated from French), Contract: DA-49-083 OSA-3137.

VESIAC 12,443 VU

This chapter has been divided into three parts. In the first, we are establishing the equations forming the basis of the theory. In Part B, we are studying shock waves in stationary motion; the obstacle is placed into an infinitely animated fluid with a uniform translation and we assume that a steady flow can be established; at each point, the velocity is independent of time. In Part C, we are studying the propagation of shock waves.

CABRE, R., S. J., Preliminary Study of the Aftershocks in the Central Andes, Sci. Rept. No. 1, Contract AF-AFOSR-792-65, Observatorio San Calixto, La Paz, Bolivia, 1967.

VESIAC 16,502 VU

Aftershock sequences in the Central Andes region for the period January 1950 to June 1963 have been examined to determine their value in a study of the region's seismicity. It was found that much of the data was unreliable due to the greater-than-normal depth of most of the earthquakes in this region. It is expected that studies of aftershock sequences of recent years will be more valuable because of the improved seismic equipment now available.

CALIF. INST. OF TECH. (STAFF), A Program in Earthquake Prediction and Prevention, Sci. Rept., Contract F44620-69C-0067, Calif. Inst. of Tech., Pasadena, Calif., 1969

VESIAC 19,830 VU

This program outlines the needs of the instrumentation, data analysis and supporting laboratory studies needed to better understand earthquake mechanism with the ultimate aim of earthquake prediction and prevention.

CALIF. INST. OF TECH., (STAFF). Research in Seismic Phenomena Connected with Earthquakes and Explosions, Annual Rept., 1 October 1966 Through 1 November 1967, Contract AF 49(638)-1337, Calif. Inst. of Tech., Pasadena, Calif., 1967.

VESIAC 17,130 VU
AD 663 219

The present report summarized results in the following categories: (1) structure of the Earth-body waves; (2) structure of the Earth-surface waves and free oscillations; (3) body wave and surface wave theoretical studies; (4) nonelastic properties of the Earth; (5) source studies; (6) instrumental development, and (7) digital and analog recording.

CALOI, P., L. MARCELLI, and G. PANNOCCHIA, "The Propagation Velocity of Surface Waves in Relation to the Atlantic," Annali di Geofisica, Vol. 2, No. 3, pp. 347-358, July 1949, (Translated from Italian), Contract DA 49-083 OSA-3137.

VESIAC 14,372 VU

On the basis of the propagation velocity of Love and Rayleigh surface waves, as analyzed from the earthquake that occurred on the mid-Atlantic ridge on April 1947, it can be concluded that the basin of the Atlantic has a uniform character from the geological point of view. The velocities observed for the surface waves are very high and are only comparable to those observed for the Pacific basin.

CALOI, P., and F. PERONACI, "The Bathyseism of August 28, 1946 and the Depth of the Earth's Core," Annali di Geofisica, Vol. 2, No. 4, pp. 493-502, October 1949, (Translated from Italian), Contract DA 49-083 OSA-3137.

VESIAC 14,377 VU

On the basis of the tracings of ScS waves from the deep earthquake of August 28, 1946, the authors proposed to calculate the depth of the earth's core. After calculating the epicenter and the hypocenter with a method based on fundamental equations of the theory of seismic rays, they determined the travel times of the ScS waves. They used the values of the propagation velocity of the transverse waves obtained by Gutenberg and Richter, and C. G. Dahm. In the first case, a depth to the core equal to 2920 km was obtained in optimum agreement with the generally accepted value; in the second case, the values were somewhat in disagreement. Gutenberg's and Richter's velocity distribution of S waves with depth, therefore, seem more reliable than Dahm's.

CAPON, J., Asymptotically Optimum Multidimensional Filtering for Sampled-Data Processing of Seismic Arrays, Contract AF 19(628)-5167, Lincoln Laboratory, Mass. Institute of Tech., Lexington, Mass., 1965.

VESIAC 13,412 VU
AD 626 188

A number of asymptotically optimum multidimensional filtering methods are investigated with the purpose of determining filtering techniques which require relatively little computing time to implement with a digital computer. The asymptotic properties of the maximum-likelihood and minimum-variance unbiased multidimensional filters are investigated in the sampled-data case. Described is why these two multidimensional filters are shown to be identical. Also discussed is the martingale property of conditional expectation. In addition, an asymptotically optimum frequency domain synthesis procedure is given for two-sided multidimensional filters.

CAPON, J., Signal Processing Results for Continental Aperture Seismic Array, Tech. Note, Rept. Nos. TN 1970-15, ESD-TR-70-149, Contract AF 19(628)-5167, Lincoln Labs., M. I. T., Lexington, Mass., 1970

VESIAC 20,302 VU
AD 707 863

The processing of short-period P-wave data from a continental aperture seismic array is considered. The array consists of sites located at the Large Aperture Seismic Array (LASA) in eastern Montana and Long Range Seismic Measurement (LRSM) stations located in North America. In particular, the feasibility of recognizing the arrival of the pP phase, making use of P-pP differences in velocity across such a large array, is considered. In addition, the determination of the P-wave source structure of an event is considered by using the array to essentially steer many beams in the vicinity of the epicenter of the event. The capability of the array to perform these two functions is evaluated and discussed in detail.

CAPON, J., R. J. GREENFIELD, and P. E. GREEN, Jr., LASA Off-Line Array Processing Results, Contract AF 19(604)-7400, Lincoln Lab., Mass. Inst. Tech., Lexington, Mass., 1965.

VESIAC 13,858-O VU
AD 648 415

The authors have processed digital array data from TFSO and LASA, the purpose being to establish trade offs between signal-to-noise enhancement achieved versus the complexity or cost of doing the processing. The results described here are relevant to the predetection array processing which Briscoe described as necessary for on-line event screening and recording.

CAPON, J., R. J. GREENFIELD, and R. J. KOLKER, A Frequency-Domain Synthesis Procedure for Multidimensional Maximum-Likelihood Processing of Seismic Arrays, Tech. Note 1966-29, Rept. No. TR-66-203, Contract AF 19(628)-5167, Lincoln Lab., Mass. Inst. Tech., Lexington, Mass., 1966.

VESIAC 14,466 VU
AD 634 233

A frequency-domain synthesis method for multidimensional maximum-likelihood filtering of sampled data from seismic arrays is presented. The several advantages of this procedure relative to the time-domain synthesis technique are discussed. Also studied are the details of a direct segment method for the spectral matrix estimation required in the frequency domain approach. The bias, variance, mean square error, limiting distribution, and other properties of the spectral estimates are included in this study. The details of a Fortran IV computer program implementation of the frequency-domain method are given. The experimental results obtained by processing two events recorded at the LASA are presented.

CAPON, J., R. J. GREENFIELD, and R. T. LACOSS, Design of Seismic Arrays for Efficient On-Line Beamforming, Tech. Note, Contract AF 19(628)-5167, Mass. Inst. of Tech., Lincoln Labs., Cambridge, Mass., 1967.

VESIAC 16,504 VU
AD 655 142

The SNR improvement obtained with delay-and-sum (DS) processing is discussed for short-period seismic data. It is shown that at least 3 km spacing should be maintained between seismometers at LASA or at another site with a similar noise environment. It is shown that noise coherency measurements are of use in determining the sensor spacing at a new array location. The parameters required for a site survey coherency measurement, such as length of data and resolution, are also presented. The design of subarrays of approximately 20 km aperture is described and array patterns are given.

CAPON, J., R. J. GREENFIELD, and R. T. LACOSS, Long-Period Signal Processing Results for Large Aperture Seismic Array, Tech. Note 1967-50, ESD-TR-67-564, Contract AF 19(628)-5167, Lincoln Labs. - MIT, Lexington, Mass., 1967.

VESIAC 17,135 VU
AD 663 429

The results of a series of off-line signal processing experiments are presented for long-period data obtained from the Large Aperture Seismic Array (LASA) located in eastern Montana. The signal-to-noise ratio gains obtained with maximum-likelihood processing are presented for body-wave as well as surface-wave phases. A discussion of the frequency-wavenumber characteristics of the noise which led to these results is also given. On the basis of these experiments several recommendations are made concerning optimum long-period array configurations and on-line or off-line processing methods.

CAPON, J., R. J. GREENFIELD, and R. T. LACOSS, Off-Line Signal Processing Results for the Large Aperture Seismic Array, Tech. Note 1966-37, Rept. No. ESD-TR-66-249, Contract AF 19(628)-5167, Mass. Inst. Tech., Lincoln Lab., Lexington, Mass., 1966.

VESIAC 14,808 VU
AD 637 016

The results of off-line processing experiments are presented for the experimental Montana LASA. In particular, the SNR gains achievable by maximum-likelihood processing, and other simpler forms of processing, are given as a function of frequency, aperture, and number of sensors. A partial discussion of the physical characteristics of the noise field which led to these results is also presented. The spurious precursor introduced by one form of signal processing, and caused primarily by the signal amplitude scatter within a subarray, can be effectively reduced by using amplitude equalization. Processing effectiveness, it was found, also depends on differences in absolute level of the noises in the various sensors.

CARD, D. C., W. H. JURNEY and T. T. SHARPS, Feasibility of Constructing Large Underground Cavities, The Stability of Deep Large-Span Underground Openings, Vol. II, Contract No. ARPA Order No. 260-62, Colorado School of Mines Research Found., Golden, Colo., 1964.

VESIAC 8343 VU

This second volume of the June 1964 technical report to the U. S. Army Engineering Waterways Experiment Station prepared by the Colorado School of Mines Research Foundation is divided into three sections. The first section deals with theoretical stress distributions on spherical cavities in homogeneous, isotropic, elastic media. The second section discusses practical considerations relating to cavity stability. The discussion covers the lithology, local structure, regional geology, and construction consideration to promote stability, involving possible linings and support, and rock bursts. The third section explains the exploration program for selected sites. The program aims at obtaining information on those factors outlined in section two. The costs and times of execution for the items making up the program are rule-of-thumb estimates only and are based on information published by well logging companies and by drilling companies.

CARDER, D. S., The Requirements of a High-Sensitivity Seismograph Station, VESIAC State-of-the-Art Rept. 4410-63-X, Contract No. SD-78, Univ. of Michigan, Institute of Sci. & Tech., Willow Run Labs., Ann Arbor, Mich., 1963.

VESIAC 7073 VU

This report discusses possible sources and methods of propagation of background noise and selection of optimum sites and methods for reducing the effect of noise. Present and suggested future arrays are included in this discussion. Highly sensitive seismograph stations and instruments in current operation are described, and comparisons are made of the ability of some of the better stations to record magnitude 4 to 5.5 earthquakes. Suggested designs of unmanned and other special-purpose seismic stations are included.

CARDER, D. S., D. W. GORDON and J. N. JORDAN, Seismic Waves from an Underground Nuclear Explosion Under a Desert Valley - MISSISSIPPI Event, Contract No. ARPA-ISSA 61-1, U. S. Coast and Geodetic Survey, Wash., D. C., 1963.

VESIAC 6017 VU
AD 412 944

This paper discussed the results of a comprehensive study of basic seismic data from a large underground nuclear explosion at the

Nevada Test Site. The MISSISSIPPI event was chosen for this purpose because it had the widest recording of any of the NTS explosions and is therefore, the most valuable in the study of travel times and amplitudes at teleseismic distances. In addition, the seismic spectra produced by the explosion contained long-period waves of significantly greater amplitude than had been observed from the NTS heretofore. A large collapse which occurred an hour or so after the explosion and a series of intervening minor collapses are also of considerable interest.

CARPENTER, E. W., Quantitative Deductions from Explosion and Earthquake Mechanism Concepts, Rept. No. 7885-1-X, Contract DA 49-083 OSA-3137, SD-78, Univ. of Mich., Inst. of Sci. & Tech., Ann Arbor, Mich., 1967.

VESIAC 15,915-M VU

The United Kingdom Atomic Weapons Research Establishment has been conducting studies on the detection, location, and identification of earthquakes and explosions. The amplitude and shape of short-period records have been the basis for this study. Velocity-depth and Q-depth models have been used to refine the magnitude scale and to obtain station corrections.

CARPENTER, E. W., Teleseismic Methods for the Detection, Identification, and Location of Underground Explosions, VESIAC State-of-the-Art Rept. 4410-67-X, Contr. No. SD-78, Univ. of Mich., Inst. of Sci. & Tech., Ann Arbor, Mich., 1964.

VESIAC 7744 VU
AD 438 710

This report attempts to show relationships between seismology and the detection and identification of underground nuclear explosions, particularly at "teleseismic distances" in the so-called third zone. Extensive preceding work on the detection, location, and identification of earthquakes and explosions is summarized, as the author attempts to delimit the teleseismic system in terms of its capabilities in these areas. It emerges from this that careful study of the recording and analysis of teleseismic signals appears valuable both in detecting underground nuclear explosions and in advancing the science of seismology. The review stops short of the distinctly political considerations, such as whether the system capability would be universally acceptable.

CARRAGAN, W., F. MICHALKO and S. KATZ, Water Wells in Earthquake and Explosion Detection, Contract No. AF 19(604)-8376, Rensselaer Polytechnic Inst., Troy, N. Y., 1964.

VESIAC 8335 VU
AD 443 378

Earthquakes and microseisms have been detected for two years through observations of water-level fluctuations in open wells and pressure fluctuations in a capped well. The transducer system composed of aquifer and detector can be adjusted to provide sensitivity comparable with long-period inertial seismographs, and bandpass extended significantly in both directions. The wells have recorded all of the phases normally detected by long-period inertial seismographs; they appear to be equally sensitive to Love and Rayleigh waves. Criteria have been established for predicting the suitability of wells for seismic detection, using relatively simple float-recorder equipment.

CENTURY GEOPHYSICAL CORP. (STAFF), Site Description of the Three-Dimensional Array, Tryon Field, Lincoln County, Oklahoma, Contract No. AF 49(638)-1084, Century Geophys. Corp., Tulsa, Oklahoma, 1961.

VESIAC 7383 VU

This paper describes the five-well pattern site location selected after investigation of a number of possible sites on the basis of hole depth, seismic noise level, and accessibility.

CHABAI, A. J., Close-in Phenomena of Buried Explosions, Final Rept., Contract No. DASA-EO-300-61, Sandia Corp., Albuquerque, N. M., 1963.

VESIAC 6872 VU
AD 423 422

The research described in this report is an attempt to obtain some information about close-in phenomena which will be helpful to the realization of objectives in the VELA-UNIFORM Program. Specific aims of this research have been the development of instruments capable of making measurements in the nonelastic region about buried explosions, investigation of medium properties of geologic solids relevant to studies of the close-in region, and development of a theory for description of spherical wave propagation from buried explosions.

CHAMBERLAIN, L. A., Multichannel Filter, Contract: VT/5053, AF 33(657)-13899, Texas Inst., Inc., Dallas, Tex., 1965.

VESIAC 13,858-M VU
AD 648 415

This report discusses the Multichannel Filter (MCF), a high-speed digital processor organized specifically for the filtering problem. Through a special purpose processor, it permits full flexibility in programming filter routines. This unit will be installed in the LASA Data Center in Montana for special processing applications. The MCF is contained in a single standard 19-inch relay rack eighty-three inches in height. The paper tape reader which is used in reprogramming the MCF is separately housed and is intended to be cart-mounted so that a single tape reader can serve several MCFs.

CHATTERTON, E. J., Optical Communications Employing Semiconductor Lasers, Tech. Rept., Rept. No. TR 392, Contract AF 19(628)-500, Mass. Inst. of Tech., Lincoln Lab., Lexington, Mass., 1966.

VESIAC 14,809 VU
AD 630 243

Discussed is the development of optical communications employing semiconductor lasers - both noncoherent and coherent. Advantages of the large modulation bandwidth obtainable with these devices are described, as well as the development of communications systems for 98-percent weather capability over short ranges (rather than fair-weather capability over long ranges), and the development of supporting technology in the areas of semiconductor lasers, photomultipliers, and frequency- and pulse-modulation electronic circuitry and components. Also, results are given for measurements of optical signals over a two-mile path under a full variety of weather conditions which permitted a comparative evaluation of AM, FM, and PM systems.

CHENG, Y-Y, Special Technical Report Number 6 on Estimation of the Depth of Focus of the May 10, 1963 Ecuador Earthquake, Tech. Interim Rept., AFCRL-56-635, Contract AF 19(628)-238, Penn. State Univ., Univ. Park, Pa., 1966.

VESIAC 15,039 VU
AD 641 366

The validity of a modified version of Merdler's (1964) depth-estimation procedure is tested. Criteria are developed to screen test significant answers. The criteria did not reject the correct solutions when applied to synthetic data.

In testing earthquake data, 237 out of 312 significant answers were rejected by the criteria. The final output seismograms chosen for each station after visual examination were reasonably simplified for records which have a large initial amplitude, while those records beginning with a small amplitude were not reasonably simplified, in general.

The average depth estimate is given.

From the consistency of the results, it appears that identification of pulses other than pP are likely.

CHIBURIS, E. F., Crustal Structures in the Pacific Northwest States from Phase-Velocity Dispersion of Seismic Surface Waves (THESIS), Contract AF 19(628)-2778, Oregon State Univ., Corvallis, Oregon, 1965.

VESIAC 12,338 VU

Phase-velocity dispersion of surface waves was determined in the Pacific Northwest states by the method of tripartite arrays. A computer technique was devised to determine rapidly periods and adjusted arrival times of wave phases. Hypothetical crustal models were proposed. Adjustment of these models is discussed. The models apply to locations near the centers of the arrays; the final models were varied laterally so as to agree with published Bouguer gravity anomalies, resulting in a crustal section from Idaho to the Oregon coast. The layers of the final model - their thickness and average physical characteristics - are discussed.

CHIBURIS, E. F., Experience at TFSO Extended Array - Travel-Time Anomalies, Contract: VT/5071, AF 33(657)-14104, Teledyne, Inc., UED, Alexandria, Va., 1965.

VESIAC 13,858-E VU
AD 648 415

To test whether travel-time anomalies exist, and whether they can be used to align signals over a large array, the author measured P-wave arrival times at the TFSO extended array stations. More than 300 teleseisms from two directions were used. Results are given here.

CHIBURIS, E. F., LASA Travel-Time Anomalies for 65 Regions Computed with the Herrin Travel-Time Table, November 1966 Version, Sci. Rept., Contract VT/6702, F33657-67C-1313, Teledyne, Inc., Alexandria, Va., 1968.

VESIAC 17,605 VU
AD 825 280

Travel-time anomalies at LASA computed from 626 teleseisms with the November 1966 Herrin tables, are separated into various regions and then averaged. Several observations are made concerning the results.

CHIBURIS, E. F., LASA Travel-Time Anomalies for Various Epicentral Regions, Sci. Rept. No. 159, Contract VT/6702, AF 33(657)-15919, Teledyne Industries, Inc., Earth Sciences Div., Alexandria, Va., 1966.

VESIAC 14,983 VU
AD 488 835

Travel-time anomalies at LASA, computed from approximately 350 teleseisms, are separated into various regions and then averaged. Several significant observations are made concerning the results.

CHIBURIS, E. F., Precision Location of Underground Nuclear Explosions Using Teleseismic Networks and Predetermined Travel-Time Anomalies, Sci. Rept. No. 214, Project VT/6702, Contract F33657-67C-13_3, Teledyne, Inc., Alexandria, Va., 1968.

VESIAC 18,338 VU
AD 832 961

Using a series of 19 explosions detonated within a 2500 km^2 area of the Nevada Test Site, the effectiveness is demonstrated of applying predetermined travel-time anomalies to a limited network of teleseismic stations (comprised of between 4 and 13 stations greater than 1900 km distance). Three different travel-time tables were used: Jeffrey-Bullen; Herrin, 1961 version; and Herrin, November 1966 version; and two different computer programs: LOCATE and SHIFT, the former which minimizes the sum of squares of residuals (and the latter which minimizes the sum of squares of relative residuals.)

CHIBURIS, E. F., Relative Travel-Time Anomalies at LASA and the Location of Epicenters using "Shift", Sci. Rept. No. 147, Contract VT/6702, AF 33(657)-15919, Teledyne Industries, UED Division, Alexandria, Va., 1966.

VESIAC 14,638 VU
AD 485 028

Anomalies from 180 events were calculated for the 21 subarrays at the Montana LASA. The anomalies are shown to be strongly dependent upon epicentral distance and direction. If the observed anomaly scatter within an epicentral region is due to epicenter location error, a computer program, SHIFT, can improve the epicenter locations from LASA by using observed P-wave arrival times and the measured average anomalies.

CHIBURIS, E. F., TFSO Long-Period L-Array Noise Coherence, Sci. Rept., Project VT/6702, Contract F33657-67C-1313, Teledyne Indust., Inc., Earth Science Div., Alexandria, Va., 1967.

VESIAC 16,908 VU
AD 821 664

Three long-period noise samples recorded at the TFSO L-array were analyzed for coherence properties. The results indicate that the ordinary coherence is generally high between elements 5 - 10 km apart and low between elements further apart. Multiple coherence is high for the first noise sample but low for the third sample.

Zero-delay noise summations for an additional sample produce about N 1/2 improvement over the average RMS noise level and beamforming of a large P-wave signal produces about N 1/2 improvement in SNR.

CHIBURIS, E. F., R. O. AHNER, The Comparative Detectability of pP at LASA, TFSO, UBSO, and CPSO, Sci. Rept., Rept. 231, Contract VT/9706, F33657-69C-0913, Teledyne Indust., Inc., Alexandria, Va., 1969

VESIAC 19,668 VU
AD 854 507

A study is made of the comparative detectability of later seismic phase arrivals, principally pP, using film data recorded at LASA, TFSO, UBSO, and TFSO. The results indicate that LASA is an equally-good or better coherent energy detector than a continental-sized network of a few stations, but, because of its small aperture, it is not as good an identifier of this energy.

CHIBURIS, E. F., and R. O. AHNER, LASA Travel-Time Data at the SDL, SDL Rept. No. 172, Contract VT/6702, AF 33(657)-15919, Teledyne Industr., Earth Sci. Div., Alexandria, Va., 1966.

VESIAC 15,167 VU
AD 803 761

Travel-time data at the SDL, as read from LASA films for approximately 400 events, are presented for users. These data have been used for computing travel-time anomalies.

CHIBURIS, E. F., and R. O. AHNER, A Location and Travel-Time Study of Aleutian Islands Explosions and Earthquakes, Sci. Rept., Rept. No. 239, Contract VT/9706, F33657-69C-0913, Teledyne Indust., Inc., Alexandria, Va., 1969

VESIAC 20,005 VU
AD 864 044

Travel-time anomalies from the LONG SHOT explosion on Amchitka Island are used to locate the Flexbag explosion approximately 70 km southwest of LONG SHOT. The results obtained using anomalies and various teleseismic networks indicate location errors less than about 10 km. Without anomalies, the location errors are 5-25 km. Comparable results are obtained when Flexbag anomalies are used to locate LONG SHOT.

In addition to the location of the explosions, 52 Aleutian Islands earthquakes, previously located by the USC&GS, were relocated using LONG SHOT anomalies. That the anomalies are valid in the immediate area of LONG SHOT and useful over a larger area is illustrated by locating 25 of these earthquakes with an eight station common network both with and without LONG SHOT anomalies. The pattern of the resultant location shifts provides insight into the problems of location stability, network resolution, and location bias.

CHIBURIS, E. F., and R. O. AHNER, A Seismic Location Study of Station Anomalies, Network Effects, and Regional Bias at the Nevada Test Site, Sci. Rept., Rept. No. 253, Contract VT/0706, F33657-70C-0941, Teledyne-Geotech, Alexandria, Va., 1970

VESIAC 20,450 VU

A location study is made of 28 large underground explosions detonated in the northern area of the Nevada Test Site (NTS). Recording networks were comprised of between 9 and 49 teleseismic stations having two- to three-quadrant distributions.

CHIBURIS, E. F., W. C. DEAN, Multiple Coherence of Long Period Noise at LASA, Rept. No. 189, Project VT/6702, Contract F 33657-67-C-1313, ARPA Order No. 624, Teledyne Inc., Alexandria, Va., 1967.

VESIAC 16,382 VU

This report shows multiple coherence versus frequency with 2 to 9 input channels for long period, vertical component noise fields at LASA.

Over the 7 to 20 seconds period range the multiple coherence on the samples tested were greater than .65 showing that 65% or more of the noise at a center channel is predictable by other seismometer outputs in the array. This level of multiple coherence requires 8 to 9 input channels. Multiple coherence with fewer inputs & ordinary coherence between pairs of channels are much lower.

From the samples tested which all produce multiple coherences quite similar to each other, we conclude that at least 9 input channels are necessary to adequately describe the long period noise at LASA.

CHIBURIS, E. F., W. C. DEAN, Multiple Coherence of Noise at 3 Vertical Arrays UBSO, GV-TX, AP-OK, Rept. No. 191, Project VT/6702, Contract F 33657-67-C-1313, Teledyne, Inc., Alexandria, Va., 1967.

VESIAC 16,393 VU

This report shows multiple coherence versus frequency at three vertical arrays of short-period, vertical-component seismometers. One of the seismic traces, either the surface trace or the deepest trace, is used as the output and 2 to 6 of the others are used as inputs.

The multiple coherence properties of the noise are similar at the three vertical arrays with similar geometries. At all three sites the downhole channels correlate with each other better than with the surface channel. At all three sites the coherence between downhole seismometers decreases markedly as their separation increases.

CHIBURIS, E. F., W. C. DEAN, Multiple Coherence of Short Period Noise at LASA, Rept. No. 190, Project VT/6702, Contract F-33657-67-C-1313, Teledyne, Inc., Alexandria, Va., 1967.

VESIAC 16,394 VU
AD 816 029

This report shows multiple coherence versus frequency with 2 to 9 input channels for short period noise fields at LASA. Intersubarray noise from the center seismometers in the 500 foot holes at LASA shows low multiple coherence for all frequencies from 0.1 to 2.5 cps even with the closest subarrays represented. The intersubarray multiple coherence indicates that the expected noise reduction from a prediction error filter is about 1 db over the fitting interval and about 0 db outside the fitting interval.

CHIBURIS, E. F., W. C. DEAN, Multiple Coherence of Short Period Noise at UBSO, and TFSO, Rept. No. 192, Project VT/6702, Contract F 33657-67-C-1313, Teledyne, Inc., Alexandria, Va., 1967.

VESIAC 16,387 VU

Multiple coherence gives a quantitative measure versus frequency of how well a linear combination of n input channels can match the (n + 1) st channel in a seismic array. If the inputs can match the output exactly, then the multiple coherence is unity and only n channels are necessary for short-period noise fields at UBSO and TFSO.

The multiple coherence of the noise at UBSO and TFSO short-period, vertical-component arrays is high (greater than 0.9) over the microseismic frequency band.

The decay of the multiple coherence of the noise with increasing frequency is faster at TFSO than at UBSO and faster at UBSO than at LASA.

CHIBURIS, E. F., W. C. DEAN, Teleseismic Signal Alignment at the Tonto Forest Extended Array, Seis. Data Lab. 125, Contract VT/2037, AF 33(657)-12447, UED Earth Sci. Div., Teledyne Industries, Inc., Alexandria, Va., 1965.

VESIAC 12,777 VU
AD 472 137

This report presents the results of determining significant travel-time anomalies at the TFSO extended array stations from more than 300 teleseisms. The results indicate that the station anomalies vary with distance and azimuth, and are necessary for signal alignment. The alignment by anomalies is shown to agree with the alignment by cross-correlations; the former method is recommended. Signal alignment errors and possible explanations of the anomalies are discussed.

CHIBURIS, E. F., R. A. HARTENBERGER, The Detection Threshold at the Montana LASA, Rept. No. 185, Project VT/6702, Contract F 33657-67-C-1313, ARPA Order No. 624, Teledyne, Inc., Alexandria, Va., 1967.

VESIAC 16,383 VU
AD 815 579

Short-period P arrivals on LASA beamformed traces for 56 teleseismic events were used to compute event magnitudes and corresponding threshold magnitudes.

The average event magnitude reported by the USC & GS differed by less than 0.1 from the average magnitude computed at LASA. Threshold magnitudes varied from 3.2 to 4.0; the average, 3.6, is biased downward about 0.1, because of the magnitude factors (B) for deep foci, and an additional 0.1-0.2 depending upon night-day noise fluctuations at the LASA.

CHIBURIS, E. F., R. A. HARTENBERGER, LASA Signal and Noise Amplitudes for Three Teleseismic Events, Scientific Report No. 151, Contract VT/6702, AF 33(657)-15919, Teledyne Industries, UED Division, Alexandria, Va., 1966.

VESIAC 14,642 VU
AD 485 032 L

Signal amplitudes, noise levels (rms) and S/N were computed from LASA recordings (1325 seismograms) of three teleseismic events; in addition, unphased and phased subarray summations were formed.

The results of this study indicate that signal amplitudes within a subarray vary by a factor of three or four and that there is an equivalent variation in subarray mean amplitudes across the entire LASA. Noise levels, on the other hand, are fairly uniform across LASA for a given event.

CHIBURIS, E. F., R. A. HARTENBERGER, Signal-to-Noise Ratio Improvement by Time-Shifting and Summing LASA Seismograms, Sci. Rept. No. 164, Contract VT/6702, AF 33(657)-15919, Teledyne Industries, Inc., Earth Sciences Div., Alexandria, Va., 1966.

VESIAC 14,980 VU
AD 800 370

S-P LASA seismograms of 19 earthquakes were prefiltered, time-shifted, and summed by digital computer to determine for each event the P-wave SNR gain relative to the average input. Compared to the mean, the "signal" amplitude, (half the maximum peak-to-trough deflection in the P signature) was suppressed on each final trace about

3 db, whereas the root-mean-square level was lowered 18 to 21 db. The prefiltering and signal alignment procedures, however, significantly reduced the first-motion amplitude of unfiltered data. The average SNR for each event was improved 15 to 18 db by summing all LASA traces. Approximately 5 db of the improvement is attributed to the modified time shifts resulting from the use of predetermined average travel-time anomalies.

CHINNERY, M. A., Earthquake Magnitude and Source Parameters, Sci. Rept., Contract F44620-67C-0006, Brown Univ. Providence, R. I., 1969

VESIAC 19,403 VU

Previous attempts to find empirical linear relationships between the magnitude, M, of an earthquake and the logarithm of one or more of the source parameters (length L, width W, displacement D) are reviewed. The fault parameters associated with a set of 27 earthquakes with strike-slip movement in the magnitude range 3.4 to 8.3 are used to test these empirical relationships. It is found that there is no linear relationship between M and log L or log W that is valid over the whole magnitude range. However, a rather good linear relationship is found between M and log D. Some improvement in determinations of the displacement D for low magnitude events is necessary in order to distinguish between these two formulas. It is surmised that the second may be closer to the truth. The consequences of such a relationship are discussed.

CHINNERY, M. A. and D. G. HARKRIDER, Seismology and Acoustic Gravity Waves, Quarterly Letter Rept., Contract F44620-68C-0082, Brown Univ., Providence, R. I., 1969

VESIAC 19,534 VU

This report summarizes the accomplishments of two tasks. The interpretation of data from the 16 mm film records from LASA has continued and the acoustic gravity wave programs are in the process of being modified to include the effect of heat conduction and viscosity.

CHINNERY, M. A. and D. G. HARKRIDER, Seismology and Acoustic Gravity Waves, Quarterly Letter Rept., Contract F44620-68C-0082, Brown Univ., Providence, R. I., 1969

VESIAC 20,085 VU

This letter report summarizes the accomplishments as follows: (1) Attention is now being focused on three aspects of the P-wave arrivals at the Large Aperture Seismic Array. (2) Theoretical barograms have been calculated for atmospheric acoustic gravity wave associated with Tsunamis.

CHOI, S. C., Principal Component Analysis of Seismic Data and Direction of the Principal Component for Seismic Record, Sci. Rept., Project VT/6702, Contract F 33657-67C-1313, Teledyne, Inc., Alexandria, Va., 1967.

VESIAC 16,364 VU
AD 814 688

This report consists of two technical notes prepared by S. C. Choi, of the Measurement Analysis Corporation. In the first report, principal component theory is developed. It was concluded that it seems quite worthwhile to investigate the applications of the principal component to seismic noise study. In the second report, the idea that the direction of noise source might be determined by examination of the principal component is pursued.

CISTERNAS, A., Research in Seismic Phenomena Connected with Earthquakes and Explosions, I. The Radiation of Elastic Waves from a Spherical Cavity in a Half Space, II. Precision Determination of Focal Depths and Epicenters of Earthquakes, Contr. No. AF 49(638)-1337, Calif. Inst. of Tech., Pasadena, Calif., 1964.

VESIAC 8580 VU

In part I of this report, the dynamic response of an elastic half space to an explosion in a buried spherical cavity is investigated by two methods. The first method is implicit and gives the final expressions for the displacements at the free surface as a series of spherical wave functions whose coefficients are solutions of an infinite set of linear equations. The second method is based on Schwarz's technique to solve boundary problems, and leads to an iterative solution. In Part II of the report, a hypocenter location program, which incorporates the method of least squares and automatically accounts for crustal variations, has been written for an IBM 7094 computer.

CLAERBOUT, J. F., The Isotropic Model of Microseisms, Contract AF 61(052)-702, Seismological Inst., Univ. of Uppsala, Uppsala, Sweden, 1964.

VESIAC 8643 b VU
AD 669 511

Theoretical study of isotropic microseisms, defined as the superposition of waves from all azimuthal angles, are made. Measurements on the earth's surface should suffice to determine phase velocities and relative powers of the surface modes present in isotropic microseisms. It should also be possible to determine whether any of the energy of these microseisms is due to body waves and, if so, to determine its power.

CLAERBOUT, J. F., A Summary, by Illustrations, of Least Squares Filters with Constraints, Technical Note 1966-7, ESD-TDR-66-22, Contract AF 19(628)-5167, Lincoln Lab., Mass. Inst. Tech., Lexington, Mass., 1966.

VESIAC 14,108 VU

Several methods of combining a number of time series into a single series are discussed. They all involve individual filtering, somewhat like Wiener filtering in that signal information is given in the form of various linear constraints on the filter coefficients rather than as a signal correlation function, and followed by summation. The formulas are worked out explicitly for the case of two time series and three filter points and presented in such a way as to make generalization clear.

CLARK, D. M., Long Range Seismic Measurements - AUK, Scientific Report No. 134, Contract: VT/2037, AF 33(657)-12447, Teledyne, Inc., UED, Alexandria, Va., 1966.

VESIAC 13,735 VU

An analysis of seismological data from an underground nuclear explosion as a continuing study to provide information to aid in distinguishing between earthquakes and explosions. A table of travel-times and amplitudes of P, Pg, Lg, and surface waves are included along with other unidentified phases.

CLARK, D. M., Long-Range Seismic Measurements - BOURBON, Project VT/6702, Contract F 33657-67C-1313, Teledyne, Inc., Alexandria, Va., 1967.

VESIAC 16,669 VU

An analysis of seismological data from an underground nuclear explosion as a continuing study to provide information to aid in distinguishing between earthquakes and explosions. A table of travel-times and amplitudes of P, Pg, Lg, and surface waves are included along with other unidentified phases.

CLARK, D. M., Long Range Seismic Measurements - BRONZE, Sci. Rept., Rept. No. SDL 132, Contract VT/2037, AF 33(657)-12447, Teledyne, Inc., Earth Sciences Div., Alexandria, Va., 1965.

VESIAC 14,953 VU
AD 627 039

An analysis of seismological data from an underground nuclear explosion as a continuing study to provide information to aid in distinguishing between earthquakes and explosions. A table of travel-times and amplitudes of P, Pg Lg, and surface waves are included along with other unidentified phases.

CLARK, D. M., Long Range Seismic Measurements -BUFF, Sci. Rept., Rept. No. SDL No. 143, Contract VT/6702, AF 33(657)-15919, Teledyne-Earth Sci. Div., Alexandria, Va., 1966.

VESIAC 14,331 VU
AD 632 956

An analysis of seismological data from an underground nuclear explosion as a continuing study to provide information to aid in distinguishing between earthquakes and explosions. A table of travel-times and amplitudes of P, Pg, Lg, and surface waves are included along with other unidentified phases.

CLARK, D. M., Long Range Seismic Measurements - CHARCOAL, Rept. No. SDL Rept. 138, Contract VT/6702, AF 33(657)-15919, Teledyne Industries, UED, Alexandria, Va., 1966.

VESIAC 14,175 VU
AD 631 043

An analysis of seismological data from an underground nuclear explosion as a continuing study to provide information to aid in distinguishing between earthquakes and explosions. A table of travel-times and amplitudes of P, Pg, Lg, and surface waves are included along with other unidentified phases.

CLARK, D. M., Long Range Seismic Measurements - CHARTREUSE, Sci. Rept. No. 156, Contract VT/6702, AF 33(657)-15919, Teledyne Indus., Inc., Earth Sci. Div., Alexandria, Va., 1966.

VESIAC 14,821 VU
AD 487 219

An analysis of seismological data from an underground nuclear explosion as a continuing study to provide information to aid in distinguishing between earthquakes and explosions. A table of travel-times and amplitudes of P, Pg, Lg, and surface waves are included along with other unidentified phases.

CLARK, D. M., Long-Range Seismic Measurements, CHASE III, Rept. No. 124, Project VT/2037, Contract AF 33(657)-12447, UED Earth Sciences Div., Teledyne, Inc., Alexandria, Virginia, 1965.

VESIAC 11,345 VU
AD 472 484

An analysis of an underwater HE shot as a continuing study to provide information to aid in distinguishing between earthquakes and explosions. A table of travel times and amplitudes of P, Pg, Lg, and surface waves are included along with other unidentified phases.

CLARK, D. M., Long Range Seismic Measurements-CHASE IV, Sci. Rept., Rept. No. SDL No. 137, Contract VT/2037, AF 33(657)-12447, Teledyne, Earth Sci. Div., Alexandria, Va., 1966.

VESIAC 14,332 VU
AD 631 052

An analysis of an underwater HE shot as a continuing study to provide information to aid in distinguishing between earthquakes and explosions. A table of travel times and amplitudes of identified as well as unidentified phases is included.

CLARK, D. M., Long Range Seismic Measurements - COMMODORE, Contract VT/6702, F33657-67C-1313, Teledyne, Inc., Alexandria, Va., 1967.

VESIAC 17,317 VU

An analysis of seismological data from an underground nuclear explosion as a continuing study to provide information to aid in distinguishing between earthquakes and explosions. A table of travel-times and amplitudes of P, Pg, Lg, and surface waves are included along with other unidentified phases.

CLARK, D. M., Long Range Seismic Measurements - CUP, Rept. No. SDL Rept. 136, Contract VT/2037, AF 33(657)-12447, Teledyne, UED Earth Sci. Div., Alexandria, Va., 1966.

VESIAC 14,098 VU
AD 629 431

An analysis of seismological data from an underground nuclear explosion as a continuing study to provide information to aid in distinguishing between earthquakes and explosions. A table of travel-times and amplitudes of P, Pg, Lg, and surface waves are included along with other unidentified phases.

CLARK, D. M., Long Range Seismic Measurements-DILUTED WATERS, Rept. No. 128, Contract AF 33(657)-12447, VELA T/2037, Teledyne, Inc., Alexandria, Va., 1965.

VESIAC 12,895 VU

An analysis of seismological data from an underground nuclear explosion as a continuing study to provide information to aid in distinguishing between earthquakes and explosions is presented. A table of travel-times and amplitudes of P, Pg, Lg, and surface waves is included along with other unidentified phases.

CLARK, D. M., Long Range Seismic Measurements - DUMONT, Sci. Rept., Rept. No. SDL 160, Contract VT/6702, AF 33(657)-15919, Teledyne Industries, Inc., Earth Sciences Div., Alexandria, Va., 1966.

VESIAC 14,945 VU
AD 489 056

An analysis of seismological data from an underground nuclear explosion as a continuing study to provide information to aid in distinguishing between earthquakes and explosions. A table of travel-times and amplitudes of P, Pg, Lg, and surface waves are included along with other unidentified phases.

CLARK, D. M., Long Range Seismic Measurements - DURYEA, Sci. Rept. No. 153, Contract VT/6702, AF 33(657)-15919, Teledyne Industries, Inc., Earth Sci. Div., Alexandria, Va., 1966.

VESIAC 14,825 VU
AD 486 268

An analysis of seismological data from an underground nuclear explosion as a continuing study to provide information to aid in distinguishing between earthquakes and explosions. A table of travel-times and amplitudes of P, Pg, Lg, and surface waves are included along with other unidentified phases.

CLARK, D. M., E. W. MOORE, and D. D. NELSON, Long-Range Seismic Measurements — FAULTLESS, Rept. No. SDL-215, Contract VT/6702, F 33657-67C-0945, Teledyne Indust., Inc., Alexandria, Va., 1968.

VESIAC 18,049 VU
AD 830 474

An analysis of seismological data from an underground nuclear explosion as a continuing study to provide information to aid in distinguishing between earthquakes and explosions. A table of travel-times and amplitudes of P, Pg, Lg, and surface waves are included along with other unidentified phases.

CLARK, D. M., Long Range Seismic Measurements - GREELEY, Sci. Rept., Rept. No. SDL 180, Contract VT/6702, F 33657-67-C-1313, Teledyne Industries, Inc., Earth Sci. Div., Alexandria, Va., 1967

VESIAC 16,076 VU
AD 813 481

An analysis of seismological data from an underground nuclear explosion as a continuing study to provide information has been made to aid in distinguishing between earthquakes and explosions. A table of travel-times and amplitudes of P, Pg, Lg, and surface waves are included along with other unidentified phases.

CLARK, D. M., Long Range Seismic Measurements - HALF BEAK, SDL Scientific Rept. No. 171, Contract VT/6702, AF 33(657)-15919, Teledyne Industries, Earth Sci. Div., Alexandria, Va., 1966.

VESIAC 15,188 VU
AD 803 769

An analysis of seismological data was made from an underground nuclear explosion as a continuing study to provide information to aid in distinguishing between earthquakes and explosions. A table of travel-times and amplitudes of P, Pg, Lg, and surface waves are in-included along with other unidentified phases.

CLARK, D. M., Long Range Seismic Measurements - KLICKITAT, Rept. No. SDL 131, Contract VT/2037, AF 33(657)-12447, UED Earth Sciences Division, Teledyne, Inc., Alexandria, Va., 1965.

VESIAC 13,012 VU
AD 627 040

An analysis of seismological data from an underground nuclear explosion as a continuing study to provide information to aid in distinguishing between earthquakes and explosions. A table of travel-times and amplitudes of P, Pg, Lg, and surface waves is included along with other unidentified phases.

CLARK, D. M., Long Range Seismic Measurements - LONG SHOT, Rept. SDL 133, Contract VT/2037, AF 33(657)-12447, UED Earth Sciences Division, Teledyne, Inc., Alexandria, Va., 1966

VESIAC 13,600 VU
AD 477 153

This report describes an analysis of seismological data from an underground nuclear explosion as a continuing study to provide information to aid in distinguishing between earthquakes and explosions. A table of travel-times and amplitudes of P, Pg, Lg, and surface waves are included along with other unidentified phases.

CLARK, D. M., Long-Range Seismic Measurements—NASH, Contract VT/6702, F 33657-67C-1313, Teledyne, Inc., Alexandria, Va., 1967.

VESIAC 18,043 VU

An analysis of seismological data from an underground nuclear explosion as a continuing study to provide information to aid in distinguishing between earthquakes and explosions. A table of travel-times and amplitudes of P, Pg, Lg, and surface waves are included along with other unidentified phases.

CLARK, D. M., Long Range Seismic Measurements - PALANQUIN, Sci. Rept., Rept. No. SDL No. 144, Contract VT/6702, AF 33(657)-15919, Teledyne, Earth Sci. Div., Alexandria, Va., 1966.

VESIAC 14,333 VU
AD 631 340

An analysis of seismological data from an underground nuclear explosion as a continuing study to provide information to aid in distinguishing between earthquakes and explosions. A table of travel-times and amplitudes of P, Pg, Lg, and surface waves are included along with other unidentified phases.

CLARK, D. M., Long Range Seismic Measurements PAR, Scientific Report No. 135, Contract: VT/2037, AF 33(657)-12447, Teledyne, Inc., UED, Alexandria, Va., 1966.

VESIAC 13,796 VU

An analysis of seismological data from an underground nuclear explosion as a continuing study to provide information to aid in distinguishing between earthquakes and explosions. A table of travel-times and amplitudes of P, Pg, Lg, and surface waves are included along with other unidentified phases.

CLARK, D. M., Long Range Seismic Measurements - PILE DRIVER, Scientific Report No. 165, Contract VT/6702, AF 33(657)-15919, Teledyne Indust., Earth Sci. Div., Alexandria, Va., 1966.

VESIAC 14,970 VU

An analysis of seismological data from an underground nuclear explosion as a continuing study to provide information to aid in distinguishing between earthquakes and explosions. A table of travel-times and amplitudes of P, Pg, Lg, and surface waves are included along with other unidentified phases.

CLARK, D. M., Long Range Seismic Measurements - PIN STRIPE, Sci. Rept. No. 154, Contract VT/6702, AF 33(657)-15919, Teledyne Indus., Inc., Earth Sci. Div., Alexandria, Va., 1966.

VESIAC 14,824 VU
AD 486 406

An analysis of seismological data from an underground nuclear explosion as a continuing study to provide information to aid in distinguishing between earthquakes and explosions. A table of travel-times and amplitudes of P, Pg, Lg, and surface waves are included along with other unidentified phases.

CLARK, D. M., Long Range Seismic Measurements - RED HOT, Sci. Rept., Rept. No. SDL No. 145, Contract VT/6702, AF 33(657)-15919, Teledyne Earth Sci. Div., Alexandria, Va., 1966.

VESIAC 14,334 VU
AD 632 957

An analysis of seismological data from an underground nuclear explosion as a continuing study to provide information to aid in distinguishing between earthquakes and explosions. A table of travel-times and amplitudes of P, Pg, Lg, and surface waves are included along with other unidentified phases.

CLARK, D. M., Long Range Seismic Measurements - REX, Sci. Rept. No. 152, Contract VT/6702, AF 33(657)-15919, Teledyne Industries, Inc., Earth Sci. Div., Alexandria, Va., 1966.

VESIAC 14,823 VU
AD 486 267

An analysis of seismological data from an underground nuclear explosion as a continuing study to provide information to aid in distinguishing between earthquakes and explosions. A table of travel-times and amplitudes of P, Pg, Lg, and surface waves are included along with other unidentified phases.

CLARK, D. M., Long Range Seismic Measurements - ROCKVILLE DAM, Sci. Rept., Rept. No. SDL 158, Contract VT/6702, AF 33(657)-15919, Teledyne Industries, Inc., Earth Sciences Division, Alexandria, Va., 1966.

VESIAC 14,961 VU
AD 488 499

An analysis of a HE shot as a continuing study to provide information to aid in distinguishing between earthquakes and explosions. A table of travel times and amplitudes of P, Pg, Lg, and surface waves are included along with other unidentified phases.

CLARK, D. M., Long Range Seismic Measurements - SCOTCH, Sci. Rept., Contract VT/6702, F33657-67C-1313, Teledyne, Inc., Alexandria, Va., 1967.

VESIAC 17,316 VU

An analysis of seismological data from an underground nuclear explosion as a continuing study to provide information to aid in distinguishing between earthquakes and explosions. A table of travel-times and amplitudes of P, Pg, Lg, and surface waves are included along with other unidentified phases.

CLARK, D. M., Long Range Seismic Measurements - TAN, Scientific Rept. No. 169, Contract VT/6702, AF 33(657)-15919, Teledyne Industr., Earth Sci. Div., Alexandria, Va., 1966.

VESIAC 15,045 VU
AD 801 879

An analysis of seismological data was made from an underground nuclear explosion as a continuing study to provide information to aid in distinguishing between earthquakes and explosions. A table of travel times and amplitudes of P, Pg, Lg, and surface waves are included along with other unidentified phases.

CLARK, D. M., Long Range Seismic Measurements - TURF, Rept. No. SDL 130, Contract VT/2037, AF 33(657)-12447, UED Earth Sciences Div., Teledyne, Inc., Alexandria, Va., 1965.

VESIAC 13,013 VU
AD 627 051

An analysis of seismological data from an underground nuclear explosion as a continuing study to provide information to aid in distinguishing between earthquakes and explosions. A table of travel-times and amplitudes of P, Pg, Lg, and surface waves is included along with other unidentified phases.

CLARK, D. M., Long Range Seismic Measurements-WISHBONE, Rept. No. 129, Contract AF 33(657)-12447, VELA T/2037, UED, Teledyne, Inc., Alexandria, Va., 1965.

VESIAC 12,894 VU

An analysis of seismological data from an underground nuclear explosion as a continuing study to provide information to aid in distinguishing between earthquakes and explosions is presented. A table of travel-times and amplitudes of P, Pg, Lg, and surface waves is included along with other unidentified phases.

CLARK, D. M., Long Range Seismic Measurements - YUBA, Rept. No. SDL Rept. 140, Contract VT/6702, AF 33(657)-15919, Teledyne Industries, UED, Alexandria, Va., 1966.

VESIAC 14,228 VU
AD 631 105

An analysis of seismological data from an underground nuclear explosion as a continuing study to provide information to aid in distinguishing between earthquakes and explosions. A table of travel-times and amplitudes of P, Pg, Lg, and surface waves are included along with other unidentified phases.

CLARK, D. M., Preliminary Beamforming Study of the TFO-37 Array, Scientific Rept., Contract VT/6702, F33657-67C-0945, Teledyne Indust., Inc., Alexandria, Va., 1968.

VESIAC 18,010 VU
AD 832 059

Beamforming of the TFO-37 array reduces the rms of the noise up to 14 db over an average single sensor, and the signal/noise improvement approaches 14 db also depending on the band pass filter used. The signal loss after beamforming and summing is approximately 1 db. Power spectra was also performed on the noise after summation as well as on individual traces and showed a 15 db reduction at 1 cps; this is an improvement of N over an average single element.

CLARK, J. W., A Seismic Classification Model, Sci. Rept., Rept. No. MTR-305, ESD-TR-67-75, Contract AF 19(628)-5165, Mitre Corp., Bedford, Mass., 1967.

VESIAC 17,307 VU
AD 659 161

This report develops a very general classification using automatic non-parametric learning based on limited data of known classification. The model accepts discriminants extracted from the seismogram and yields the probability that the input was due to an earthquake or an explosion. Thus, the discriminants are assumed to be available as inputs. Pattern recognition as used here is defined, the classification procedure is outlined, the adaptive estimation of joint probability-densities from a finite number of multi-dimensional vectors of known classification (the learning model) is discussed, a simplified flow diagram of the learning model is presented, and the selection of necessary control parameters is investigated.

COHEN, T. J., Determination of Source Depth by Spectral, Pseudo-Autocovariance, and Cepstral Analysis, Sci. Rept., Rept. No. 229, Contract VT/6702, F33657-68C-0945, Teledyne Indust., Inc., Alexandria, Va., 1969

VESIAC 19,304 VU
AD 848 100

Interference of P (or Pn) and pP (or pPn) produce scalloped spectra with a null period equal to the depth-phase time delay τ. Determination of the null-frequency ($f = 1/\tau$), together with a knowledge of the overburden compressional velocity, permits an estimate of the source depth. Scalloping produced by station site structures is reduced by averaging a suite of station spectra. Further, the spectral band available for analysis is broadened be removing instrument response. To objectively determine periodicities in the average spectrum, the cepstra and psuedo-autocovariance are computed. The depth determination method employing spectral, psuedo-autocovariance, and cepstral analysis is applied to nine Pn and P data sets for five underground explosions. Five sets yielded reasonable estimates of the shot depth.

COHEN, T. J., Seismoprints - Sci. Rept., Rept. No. 238, Contract VT/9706, F33657-69C-0913, Teledyne Indust., Inc., Alexandria, Va., 1969

VESIAC 20,082 VU
AD 865 357

Contour spectrograms (seismoprints) of short-period P and P-coda signals display power as a function of frequency and time. Analyses of LONG SHOT and an Andreanof Island earthquake (22 November 1965) by means of seismoprints effectively show the complex time-frequency-power relationships within the earthquake's P-coda; the explosion prints exhibit much simpler signatures. This suggests that volume integrals derived from earthquake and explosion seismoprints can be used to compute complexity factors. For the explosions, repetitive, characteristic signatures are found for the P and PcP arrivals (and for the P- and PcP-codas).

COKE, C., Seismological Stations in the Union of Soviet Socialist Republics, Rept. No. 4410-113-X, VESIAC Special Rept. Contract SD-78, Inst. of Sci. & Tech., Univ. of Mich., Ann Arbor, Mich., 1964.

VESIAC 12,181 VU
AD 281 285

This report presents a detailed description of the most consistently active seismic stations in the USSR. Included is information on the geography, geology, seismicity, and crustal characteristics in the vicinity of the stations as well as the type of instruments in operation at the stations with their constants and frequency responses.

COLLINS, J. L., and D. W. EVERTSON, Quarterly Status Report No. 1 on Contract CGS-1198 for the Period 1 November 1963 Through 31 January 1964, Contract CGS-1198, Univ. of Texas, Austin, Texas, 1964.

VESIAC 13,808 VU

Work was begun on the solion seismic detection system in late October. A "one-meter seismometer" was designed and construction is nearly complete. Plans have been made to conduct an extensive test of the seismometer at The Geotechnical Corporation, Garland, Texas. An equivalent electrical circuit has been derived for the seismometer using classical analogies. Background material on the solion linear pressure detector is included for reference.

COLLINS, J. L., and D. W. EVERTSON, Quarterly Status Report No. 2, 1 February Through 30 April 1964, Contract CGS-1198, Univ. of Texas, Austin, Texas, 1964.

VESIAC 12,015 VU

Some experiments were performed on the horizontal unit with the Geotechnical Corporation shake table at Garland, Texas. These tests were helpful, but not complete. It was decided to build a horizontal shake table at Defense Research Laboratory suitable for our particular instrument. It is planned to conduct some tests during the next quarter at the Sandia Base, Albuquerque, New Mexico. Preliminary design work has been done on the vertical unit.

COLLINS, J. L. and D. W. EVERTSON, A Solion Seismometer, VESIAC Rept. No. 4410-77-X, Contr. No. SD-78, Univ. of Michigan, Inst. of Sci. & Tech., Ann Arbor, Michigan, 1964.

VESIAC 8865G VU
AD 452 161

In this paper, the solion transducer and the basic principles that describe the solion action are discussed. Also included is a discussion of how the solion is joined with a fluid inertial mass system in an effort to enhance the acceleration sensitivity of the transducer. Because the solion seismometer is new, an empirical calibration has not yet been made. The sensitivity presented is based upon the measured pressure response of the solion and the predicted effects of the fluid mass system.

COLLIVER, M. M., P. DEHLINGER, Oregon State University Seismological Bulletin No. 2, Rept. No. 16, Contract AF 19(628) 2778, Oregon State Univ., Corvallis, Oregon., 1964.

VESIAC 8591 VU
AD 606 774

This bulletin lists the seismic data visually recorded during the period October-December, 1963 at the two seismological stations (Corvallis and Klamath Falls) operated by Oregon State University. Instrumentation included both S-P and L-P seismographs plus small vertical Benioff seismographs.

COLLIVER, M. M. and P. DEHLINGER, Seismological Bulletin No. 1, 1 July to 30 Sept. 1963, Contr. No. AF 19(628)-2778, Oregon State Univ., Corvallis, Oregon, 1963.

VESIAC 7836 VU
AD 600 463

This report contains data from the Oregon State University seismic station at Corvallis, (one of the World-Wide Cooperative

Standard Seismograph Network of Stations), for the period 1 July to 30 September 1963. Instrumentation and station constants are given. A list of abbreviations for data interpretation is given. Included are dates of events, phases, times, periods and remarks.

CONNOR, J. J., Seismograph Calibration Standards, Project VELA UNIFORM, Contr. Agency Document, Air Force Technical Applications Center, Wash., D. C., 1963.

VESIAC 7572 VU

The purpose of this report is to indicate proper seismograph calibration standards and how to achieve them. The instructions consider: 1) scope; 2) special calibration method (for short period, long period, broadband, intermediate band); 3) daily calibration (indicating proper frequencies and ground motion adjustments); 4) basic calibration method; 5) calibration logs; formulae for computing magnifications for the special calibration; 6) procedure for determining calibrator coil motor constant; and general information on tape recorder frequency and record time, and measurement and recording of signal-to-noise ratio for each tape recorder channel.

COOK, K. L., and J. K. COSTAIN, Research Directed toward the Study of PS Converted Seismic Waves, Semiannual Tech. Rept. No. 5, Contract No. AF 19(638)-201, Univ. of Utah, Salt Lake City, Utah, 1963 (OFFICIAL USE ONLY).

VESIAC 7246 VU O

COOK, K. L., J. K. COSTAIN, A Study of PS Converted Waves, Final Rept. No. AFCRL 65-258, Contract AF 19(628) 201, Univ. of Utah, Salt Lake City, Utah, 1965.

VESIAC 10,530 VU
AD 615 474

This investigation was concerned with the properties of PS converted waves to ascertain whether they can be detected consistently on seismograms from underground nuclear explosions and earthquakes, and whether they can be used to distinguish such explosions from earthquakes. The study included: a) theoretical considerations of the amplitudes of PS and other converted waves as compared to observed amplitudes; b) harmonic analysis of seismograms; c) analyses earthquakes at the University of Utah stations and other stations--to develop criteria for the recognition of PS converted waves was the goal; d) recognition of waves recorded on vertical and horizontal seismometers at Geotech.

COSTAIN, J. K., and K. L. COOK, Tables of Energy Ratios, Amplitude Ratios, and Phase Angles for Plane SV Waves, Special Report 4410-96-X, SD-78, Univ. of Mich., Inst. of Sci. & Tech., Ann Arbor, Mich., 1965.

VESIAC 10,665 VU

This report presents tabulations of energy ratios from Knott's energy equation, amplitude ratios from the Zoeppritz equations, and phase angles computed from the complex amplitude ratios for a plane SV wave incident on a plane elastic discontinuity. All computations were programmed in FORTRAN for an IBM 7040 digital computer. For a Poisson's ratio of 0.250, incident angles were varied from 0 deg. to 88 deg. in increments of 2 deg., except near phase change of 180 deg. in the real domain and near the critical angles where the ratios were calculated in increments of 5 deg. Real and imaginary coefficients were considered. Described are the varying parameters, the compressional velocity ratios, and the density ratios used.

COSTAIN, J. K., K. COOK, and S. T. ALGERMISSEN, Tables of Amplitude and Energy Ratios for Plane SV Waves, VESIAC Spec. Rept. 4410-68-X, Contract No. SD-78, Univ. of Michigan, Inst. of Sci. & Tech., Willow Run Labs., Ann Arbor, Mich., 1963.

VESIAC 7219 VU

This report presents tabulations of energy ratios calculated from Knott's energy equation and amplitude ratios calculated from the Zeoppritz equations, for a plane SV wave incident on a plane elastic discontinuity. All computations were programmed in FORTRAN for an IBM 1620 digital computer. The variation of incident angles is described. Both real and imaginary coefficients were considered in the calculations. The varying parameters were the velocity ratio and density ratio across each interface, and the angle of incidence. Computation of energy and amplitude ratios is described. The kinds of compressional velocity ratios and density ratios that were used are described.

COX, D. C. and R. H. JOHNSON, Pacific T-Phase Epicenters, Tech. Summ. Rept. No. 3, Contract No. Nonr 3748(01), Univ. of Hawaii, Honolulu, Hawaii, 1962.

VESIAC 5722 VU

Earthquake T-phases were studied by means of sound-channel hydrophones of the Pacific Missile Range at Kaneohe, Hawaii. A rotating-drum-type recorder allowed continuous monitoring of the sound channel. The record consists of a logarithmic presentation of sound power versus time. A geographic study was made of T-phase sources and associated earthquake epicenters.

The seismicity of Hawaii places the Kaneohe hydrophones in the unique position of recording seismic waves in the process of transformation to underwater sound. Several local earthquakes have been identified and parameters of reception of this type of signal are discussed.

COX, K. C. and R. H. JOHNSON, T-Phase Study, Semiannual Tech. Study Rept. No. 1, Contract No. Nonr 3748(01), Univ. of Hawaii, Honolulu, Hawaii, 1962.

VESIAC 6609 VU

This is a Hawaii Inst. of Geophys. report on research for a contract which requires the monitoring by deep hydrophone and studying of all submarine low-frequency acoustic events. Due to the pacity of large-yield submarine explosions, the bulk of attenuation is necessarily concentrated on earthquake T-phases. Initial study is being made of the following points: 1) T-phase source location; 2) Areas from which identified T-phases are received; and 3) Spectral composition of representative signals.

CRAMPIN, S., Higher Modes of Seismic Surface Waves, Preliminary Observations, Contract AF 61(052)-702, Seismological Inst., Univ. of Uppsala, Uppsala, Sweden, 1964.

VESIAC 8640 a VU
AD 832 568 L

Higher modes are found in about 40 percent of earthquakes with medium amplitude in Sweden. They are confined to continental paths avoiding disturbed areas of the crust. The higher mode group velocity dispersion curves of 81 of these earthquakes are presented here.

CRAMPIN, S., M. BÅTH, Higher Modes of Seismic Surface Waves - Mode Separation Appendix, Contract AF 61(052)-702, Seismological Inst., Univ. of Uppsala, Uppsala, Sweden, 1964.

VESIAC 10,030 VU
AD 633 304

A digital computer is used to filter seismograms in order to separate the higher modes from each other and from fundamental modes and microseisms. The filtered traces show higher modes for a longer time than the original seismogram and modes may be visible which were previously undetected. Mode Separation results in some alterations to dispersion curves measured from original seismograms.

CREASEY, G., Auxiliary Processor Simulator, CPO Special Rept. No. 3, Contract VT/6704, AF 33(657)-14648, Texas Inst., Inc., Dallas, Texas, 1967

VESIAC 19,498 VU

The digital MCF auxiliary processor has been simulated by a computer program to facilitate the checkout of the processor and to study various operating parameters. The program follows the logic of the processor as much as possible and contains the following main sections: basic MCF filter routine, beam-steer routine, Wiener power processor, UK processor, Fisher output controller, and divide routine.

CROUCH, D. B., Analysis of Subarray Wavenumber Spectra-Large-Array Signal and Noise Analysis, Special Sci. Rept. No. 6, Contracts: VT/6707, AF 33(657)-16678, ARPA Order No. 599, Texas Inst., Inc., Dallas, Texas, 1967.

VESIAC 17,128 VU

The ambient seismic noise at LASA was studied using high-resolution wavenumber spectra obtained for several subarrays chosen from seven noise samples covering a seven month period. A comparison of the high-resolution spectra with conventional spectra measured at two subarrays for one of the noise samples was made.

CROUCH, D. B., Detection of Discrete Arrivals in Mantle P-Wave Noise Large-Array Signal and Noise Analysis, Special Sci. Report No. 5, Contract VT/6707, AF 33(657)-16678, Texas Inst., Inc., Dallas, Texas, 1967.

VESIAC 16,914 VU

Two techniques have been used to identify discrete P-wave arrivals. One method, Fisher analysis of variance, provides an output time function which measures the likelihood of an arrival in a specific segment of noise. The other technique calculates a moving power spectra and looks for spectral characteristics which are sufficiently deviant from the expected values of a Gaussian stationary process. Using an 8-min noise sample, the methods were able to detect no discrete arrivals propagating across the array as plane waves. Within the resolving power of these tests, no small P wavelets appeared to be in the mantle P-w.. e noise.

CUMMING, G. L., Investigation of the Crust in Western Canada by Seismic Refraction, Semiannual Tech. Rept., Contr. No. AF 19(628)-2835, Univ. of Alberta, Edmonton, Alberta, Canada, 1964.

VESIAC 7844 VU

Preliminary travel time curves for the data from Suffield, Alberta to Swift Current, Saskatchewan are interpreted. The travel time curve from Suffield to Swift Current shows well defined first arrivals to a distance of 225 km. The arrivals from 125 km, 75 km, and 100 km are described, and a well velocity survey to basement approximately 10 km from the Suffield shot point. The profile also yields a good lineup of second arrivals with a velocity close to 8 km sec and an intercept time of 9 seconds. Reverse control for this profile is presented for data shot from Swift Current, west to a point somewhat beyond the Suffield shot point. In Section 2 of the report power spectra are discussed; in Section 3 magnetotelluric measurements are interpreted.

CUMMING, G. L., Investigation of the Crust in Western Canada by Seismic Refraction, Semi. Tech. Rept., Contr. No. AF 19(628)-2835, Univ. of Alberta, Alberta, Canada, 1964.

VESIAC 8843 VU

This report includes a copy of one of the deep-reflection records obtained in the summer of 1964 in the vicinity of the refraction line from Suffield west. This record shows a strong reflection at 11.5 seconds, and several weaker and less coherent reflections in the following portion of the record, to a time of about 15 seconds. There is little indication of any coherent arrivals between the end of the first arrival pulse and the reflection at 11.5 seconds. Each shot consisted of four 100-foot hotes with 50 lbs. of dynamite in each hole. The holes were 100 to 200 feet apart in line with the profile, in an attempt to cancel surface waves. Enhancement of the desired frequency band, and information helpful in separating reflections from possible multiples were obtained.

CUMMING, G. L., E. R. KANASEWICH, Crustal Structure in Western Canada, Final Sci. Rept., 1 May 1963 to 30 April 1966, Rept. No. AFCRL-66-519, Contract AF 19(628) 2835, Univ. of Alberta, Edmonton, Alberta, Canada, 1966.

VESIAC 14,985 VU
AD 639 679

This report deals with crustal seismic refraction and reflection measurements in western Canada. Evidence is presented to support three major layers in the crust below the sediments, with velocities of 6.1, 6.5 & 7.2 km sec. The total crustal thickness is about 45 km. Refraction measurements indicate substantial lateral velocity variations in the crust, and these are related to large variations in the gravity field. Preliminary data suggest the presence of a low velocity layer in the upper mantle at a depth of about 120 km. Reflection measurements indicate that a strong reflecting horizon is present at a depth close to the top of the 7.2 km sec layer. This reflector appears to be continuous over distances of several tens of kilometers.

CUMMING, G. L., G. T. MAUREAU, Crustal Structure in Western Canada, Sci. Rept. No. 1, Rept. No. AFCRL-65-15, Contract AF 19(628)-2835, Univ. of Alberta, Alberta, Canada, 1964.

VESIAC 9581 VU
AD 611 129

In the summers of 1963 and 1964, a double-ended refraction profile was shot between Suffield, Alberta and Swift Current, Saskatchewan. A six layer earth model was obtained, the crustal thickness under the east shot point (Swift Current) being 42 kms and the thickness under the west shot point (Suffield) being 51 kms. These data are similar to those reported by Meyer and McCamy in Montana, just south of the line of the authors of this article. Previous control west from Suffield has been extended into the Rocky Mountains. Since these data are not reversed, definitive interpretation is not possible. Alternative interpretations are presented. Power spectra indicate little change in frequency with distance from the shot point; however, two dominant frequencies of seismic information are presented.

CURRIE, R. G., A Comparison of Long Shot and Earthquakes, Final Tech. Rept., Rept. No. RP-40, Contract AF-AFOSR-1022-66, Arctic Inst. of North Am., Montreal, Quebec, 1967.

VESIAC 17,018 VU
AD 661 976

The seismic signal generated by the underground nuclear explosion, Long Shot, has been compared with seismic signals of earthquake origin and found to be similar on a regional scale. Negative Long Shot magnitude residuals are associated with areas of recent tectonic activity as are late arrivals, while positive Long Shot magnitude residuals and early arrivals have been found to be associated with tectonically stable regions. These trends are coincident with those indicated by data from other seismic events.

CUSHING, V. J., W. A. LOSAW, and D. M. REILY, Characteristic Emissions from an Underground Explosion, Computational Technique and Results, Contr. No. DA-49-146-XZ-089, Engineering-Physics, Co., Rockville, Md., 1964.

VESIAC 8013 VU

During the past year a computational program has been under development to describe the mechanical disturbance generated by an underground explosion. In this report, the basic equations which describe the propagation of intense mechanical disturbances through geologic media are discussed. Additionally, the authors describe techniques for implementing the numerical solution of the equations of wave propagation applicable to both the region of linear and nonlinear constitutive behavior; and in particular, they have written a computer program, using a numerical technique which allows one to solve the wave propagation problem for a medium having an equation of state which loads and unloads along different state point loci.

CUSHING, V.J., D. REILY, and W. LOSAW, Characteristic Emissions From An Underground Explosion, Rept. No. DASA 1689, Contract DA-49-146-XZ-089, Engineering-Physics Company, Rockville, Maryland. 1965.

VESIAC 13,014 VU
AD 476 003

The propagation of a mechanical disturbance from a point-source explosion with particular emphasis on characteristic waveshapes as effected by bulk equations-of-state is investigated. The principal concern here is with the analysis and with numerical methods for studying the progress of an underground shock wave through the crushable region near the explosive source. The numerical method is noteworthy in that it can accommodate quite general bulk equation-of-state information (including different loading and unloading characteristics). It is intended that the numerical analysis be coupled to a suitable linear analysis so that waveshapes in the near seismic region may be compared with the available experimental data.

DATSKEVICH, A. A., "Testing of Seismic Receivers," Prikladnaya Geofiz., No. 13, pp. 47-64, 1956, (Translated from Russian), Contract SD-78.

VESIAC 12,359 VU

The seismic receiver is the input unit of the recording channel of any seismometric or vibrometric apparatus. In view of this, the parameters of the seismic receiver are of decisive importance to the characteristics of the recording channel as a whole. For this reason, the sound selection of the parameters characterizing the receiver and the working out of methods of measuring and checking these parameters are very significant; and the lack of attention to this problem leads to difficulties in designing and constructing apparatus for seismic exploration. In this paper is established a system of parameters characterizing the receiver. A method is chosen for their measurement and control. The concept of the seismic receiver as electromechanical dipole is used.

DAUBIN, S. C., Pacific "SOFAR" Velocity Calibration Experiment, TR 65-28, Contract NOnr 4298(00), GM Defense Res. Lab., Santa Barbara, Calif., 1965.

VESIAC 11,340 VU

Experimental results of SOFAR velocity measurements made between Hawaii and the California coast and between Hawaii and certain islands in the Pacific in the summer of 1964 are given. Locations of explosive source stations are given. A source location program for the IBM 7040 computer was developed and used to locate explosive sound sources from signals received at a widely spaced ensemble of receiving stations. Signals were recorded by various stations in the North Central Pacific and also by an acoustic monitoring buoy station anchored off the California coast. The objectives of the experiment are given.

DAVIES, D., Seismic Discrimination, Semiannual Tech. Summ. Rept., 1 Jan. to 30 June 1970, Rept. No. ESD-TR-70-193, Contracts: AF 19(628)-5167, AF 49(638)-1763, Lincoln Labs., M. I. T., Lexington, Mass., 1970

VESIAC 20,341 VU
AD 710 613

Detailed studies of short-period characteristics of explosive sources on a global basis have been completed. Substantial effort has been expended in the study of propagation path phenomena, aimed at the understanding of discriminant capabilities and limitations at low magnitudes. LASA data have been used for several projects involving the detailed characteristics of seismic waves from explosions and earthquakes. A continuous improvement in our data facilities and automatic processing capabilities is reported.

DAVIS, R. W., Evaluation of B and D Summation Traces at the Tonto Forest Seismological Observatory, Spec. Rept. No. 13, Project VT/70, Contract AF 33(657)-7747, United Electro Dynamics, Inc., Pasadena, Calif., 1964.

VESIAC 11,790 VU
AD 609 531

Data from a recording period of two full months have been analyzed. Table I tabulates these results. Briefly, these may be summarized as follows: a) Summations B and B_1 appear to be nearly identical in quality of signal reception to Summations D and D_1 at the gains used. b) Summation D_2 has a more prominent high frequency background than Summation B_2. This reduces its reception quality very slightly on low level events. c) The increase in high frequency background due to increased gains on Sums B_1 and D_1, and particularly on Sums B_2 and D_2 decreases the probability of "ip" starts. This is to be expected from past analytic experience.

DAVIS, W. J., Analysis of 2 CPS Wave Trains on the Seismograph Array at Mould Bay, Northwest Territory, Canada, Contr. Agency Document, Air Force Technical Applications Center, Wash., D. C., 1964.

VESIAC 7612 VU

This paper reports results at the VELA Seismological Center of an investigation to determine the source direction and phase velocity of wave trains using cross-correlation techniques. The array at Mould Bay produced seismograms on August 2nd and 8th 1963, showing a series of sinusoidal wave trains containing a few too many tens of cycles. The series of wave trains persisted for 20-30 minutes. Peak amplitudes, periods, dominant frequencies are discussed. The emergent character of each wave train makes it difficult to estimate the direction and velocity of propagation. On a few of the shorter wave trains, the step-out of the dominant energy suggests a north travelling wave of very slow velocity. But generally the step-out is indeterminant.

DAVIS, W. J., Large Aperture Arrays, Contract: Agency Document, Air Force Tech. Appl. Center, Washington, D. C., 1965.

VESIAC 13,858-I VU
AD 648 415

An array, when operated as a velocity-phase simple summation, is a wavenumber filter. The filter passes events corresponding to the phasing velocity and attenuates all other events. If the phasing velocity is constant over the array, the response of the wavenumber filter is a function only of the array geometry. The authors examine the wavenumber response of LASA and suggest an alternative geometry for any subsequent LASA development.

DAVIS, W. J., Operation MIRACLE PLAY, VELA UNIFORM Program, Contract Agency Document, Defense Atomic Support Agency, Sandia Base, N. M., 1968.

VESIAC 13,210 VU

This is the test plan for Operation Miracle Play, a series of detonable gas shots in the Salmon/Sterling cavity. The cavity is located in the Tatum Salt Dome near Hattiesburg, Mississippi. The operation has two principal objectives: simulation of blast effects of contained, underground nuclear explosions in cavities and measurement of the reduction in decoupling caused by overdriving a cavity. Three shots are planned. Two will have a yield of 315 tons and a third will have a yield of about 890 tons. The first shot is expected to match the Sterling event. The second shot is to examine the effect of the trapped water and additional spalled material from the first shot on the response of the cavity. If the first two shots yield similar distant earth motion, then the third shot will be executed. The events are scheduled for December 1968 and February and April 1969.

DAVIS, W. J., and J. C. BRADFORD, Analysis of Short-Period Noise and Arrays at Three English Seismological Observatories, Agency Document, Vela Seismological Center, Washington, D. C., 1965.

VESIAC 10,381 VU

From data supplied by the United Kingdom Atomic Energy Authority, the structure of the vertical component of the earth's noise field is described in terms of its power as a function of frequency and wave number at three observatories. The wave-number response of the arrays on the basis of a uniformly weighted summation is computed. The three observatories studied were: Eskdalemuir, Scotland; Yellowknife, Canada; and Pole Mountain, Wyoming.

Meaningful wave-number spectra were obtained for Eskdalemuir and, in part, for Pole Mountain. The large relative spacing of the array elements at Yellowknife caused severe aliasing, leading to uninterpretable spectra.

DAY, J. D., D. W. MURRELL, Ground and Water Shock Measurement - PROJECT LONGSHOT, Final Rept. No. VUF-2701, Contract: Agency Document, Defense Atomic Support Agency, Washington, D. C., 1967.

VESIAC 16,075 VU
AD 813 536 L

Excellent ground motion records of the LONGSHOT event were obtained, both surface and downhole from the event. In addition, two of the four water stations produced good data. The explosion was successfully contained despite a surface zero transient displacement of 7.3 feet. The ground-induced water pressure at the close-in shoreline stations was insufficient to injure marine wildlife.

DEAN, W. C., Fourier-Laguerre Transforms, Section II, Contract No. AF 49(638)-1117, United ElectroDynamics, Inc., Alexandria, Va., 1963.

VESIAC 6849 VU

This paper describes the numerical methods suitable for machine computation of both direct and inverse Fourier transforms from the Laguerre expansions. These methods show how both the semi-infinite time and frequency domains are covered simultaneously by a finite number of sample points. The Laguerre sampling points in time cluster near the origin, and the Laguerre sampling points in frequency cluster symmetrically about resonance on a logarithmic frequency scale. Examples given show that convergence of the method is best for low Q, singly resonant filters and transients.

DEAN, W. C., Inverse Filtering of Seismic Signals, Contr. No. VT/2037, AF 33(657)-7427, United ElectroDynamics, Inc., Pasadena, Calif., 1962.

VESIAC 7992 VU

The objective of inverse filtering for the problem of seismic blast identification is to remove the distortion effects of the transmission medium. After discussion the theory of inverse filtering, the author shows that the two major obstacles, with regard to the use of inverse filtering for seismic blast identification are: a) finding what the proper filter to invert is, and b) noise. There are several approaches. The advantages and disadvantages of each are discussed. The approaches discussed here are: a) phase equalization method; b) auto- and cross-correlations; c) non-linear inverse filters; and d) inverting (known) recording instruments (e.g., the seismometers).

DEAN, W. C., Long-Range Seismic Measurements - KNICKERBOCKER, Rept. No. SDL-208, Contract VT/6702, F33657-67C-1313, Teledyne, Inc., Alexandria, Va., 1968

VESIAC 18,040 VU
AD 828 030

The purpose of this report is to provide an analysis of data resulting from the KNICKERBOCKER event recorded by the LRSM teams and the VELA observatories and a preliminary summary of data reported by other permanent and temporary seismographic stations.

DEAN, W. C., Preliminary Plans: SDL Processing of LASA Data, Contract: VT/5071, AF 33(657)-14104, Teledyne, Inc., UED, Alexandria, Va., 1965.

VESIAC 13,858-S VU
AD 648 415

The requirements for velocity filtering teleseismic P waves over a large array are discussed, as well as the basic approaches to velocity filtering inputs. Experience with TFSO shows that the travel-time anomalies determined by film analysis and by computer cross-correlation are in agreement. The author recommends film analysis since it is faster. Also, it is cheaper and more convenient to save the large quantities of LASA data necessary to calibrate the array in all desired azimuths and distances on film rather than magnetic tape.

DEAN, W. C., Rayleigh Wave Rejection by Optimum Filtering of Vertical Arrays, Sci. Rept. No. 166, Contract VT/6702, AF 33(657)-15919, Teledyne Industries, Inc., Earth Sciences Division, Alexandria, Va., 1966.

VESIAC 14,966 VU
AD 489 935

Optimum array processes such as the maximum-likelihood filters are usually derived from the cross-correlation matrix of the time series outputs of the array. With a vertical array, however, the correlations of the incoming P-wave signals and Rayleigh-wave noise are predictable from the structure. This paper presents the theory of maximum-likelihood filters in vertical arrays which can provide undistorted estimates of the signal or the various Rayleigh modes with the other modes cancelled out. The performance of these optimum processes will be dependent upon the validity of the underlying assumptions presented here. Examples are shown of the performance of the optimum filters using synthesized data where the underlying assumptions are satisfied.

DEAN, W. C., Seismic Data Laboratory - Services Report, Sci. Rept., Contract VT/6702, F33657-67C-1313, Teledyne, Inc., Alexandria, Va., 1968.

VESIAC 17,303 VU

This report lists the data services, computer programs and other data available from the seismic data laboratory. The following items are described: (1) digital computer programs; (2) digitized seismic data; (3) U. S. Coast and Geodetic Survey Epicenters; (4) Earthquake Bulletin data; and (5) Shot report data from 82 U. S. nuclear explosions.

DEAN, W. C., Seismological Applications of Orthogonal Function Study Expansions, Quarterly Rept. No. 2, 1 May Through 31 July 1962, Contract AF 49(638)-1117, United ElectroDynamics, Inc., Pasadena, Calif., 1962.

VESIAC 10,655 VU
AD 419 789

A generalized class of functions orthogonal over the range of greater than or equal to zero to less than or equal to infinity possess frequency responses which are rational fractions with the pattern of zeros equivalent to the mirror image of the pattern of poles across the imaginary frequency axis. Consequently, complete sets of orthogonal functions can be defined by specifying their pole patterns. Circuits with these same frequency responses, modeled on an analog computer, have impulse responses which are the orthogonal functions themselves. Examples of several such sets, presented here, show what resonant and decay characteristics of the time functions result from different pole patterns.

DEAN, W. C., Seismological Applications of Orthogonal Function Expansions, Semiannual Tech. Summ. Rept. No. 3, Contract No. AF 49(638)-1117, United ElectroDynamics, Inc., Pasadena, Calif., 1962.

VESIAC 6253 VU
AD 419 789

A generalized class of functions orthogonal over the range less than or equal to zero to less than or equal to infinity possess frequency responses which are rational fractions with the pattern of zeros equivalent to the mirror image of the pattern of poles across the imaginary frequency axis. Consequently, complete sets of orthogonal functions can be defined by specifying their pole patterns. Circuits with these same frequency responses, modeled on an analog computer, have impulse responses which are the orthogonal functions themselves. Examples of several such sets, presented here, show what resonant and decay characteristics of the time functions result from different pole patterns. Also examples of the performance of the Laguerre analyzer are included.

DEAN, W. C., Seismological Applications of Orthogonal Function Expansions, Semiannual Tech. Summ. Rept. No. 8, Contract No. AF 49(638)-1117, United ElectroDynamics, Inc., Pasadena, Calif., 1963.

VESIAC 6263 VU

Investigations of time varying spectra of earthquake and shot data using orthogonal filters are continuing. This report presents some of the first variable density records with time as the continuous variable and frequency (or orthogonal channel) as the discrete variable. The report also contains four papers that have been or will be presented for publication. Section II presents the basic paper of this orthogonal function study on Fourier-Laguerre transforms. Section III presents the zeros and weight factors necessary to the numerical evaluation of Fourier-Laguerre transforms for selected Laguerre polynomials. Section IV considers generalized Laguerre functions and their Laplace transforms; Section V considers seismological applications of Laguerre expansions.

DEAN, W. C., Seismological Applications of Orthogonal Function Expansions, Semiannual Tech. Summ. Rept. No. 11, Contract AF 49(638)-1117, United ElectroDynamics, Inc., Pasadena, Calif., 1964.

VESIAC 7520 VU
AD 432 765

This report is in three sections. Section I presents some teleseismic events recorded through the time varying spectral analyzer using orthogonal and non-orthogonal filters. Section II presents a method for efficient simulation of analog filters in a digital computer. Section II also discusses attempts to improve the accuracy of this basic approach. Section III describes studies of the rate of convergence of orthogonal expansions for teleseismic P waves. These studies show that fast convergence of orthogonal expansions for teleseismic P waves are particularly sensitive to Q as well as resonant frequency. These teleseisms seem to have resonances near 1.0 cps and Q's from 1.0 to 2.0.

DEAN, W. C., Teleseismic Signal and Noise Correlations at the Tonto Forest Extended Array, Rept. No. 123, Project VT/2037, Contract AF 33(657) 12447, UED Teledyne, Alexandria, Va., 1965.

VESIAC 11,796 VU
AD 466 975

This report presents signal correlations for P-waves from some teleseismic events recorded over the TFSO extended array. The variation of correlation with distance is determined from the seismometer separation. The variation with frequency is determined by filtering the seismograms prior to correlating. Noise correlations are determined by the same analysis for data samples just prior to the onset of the signals. Six results of this correlation study are included.

DEAN, W. C., L. D. ENOCHSON, and R. H. SHUMWAY, The Coherency Analysis of Seismic Noise, Sci. Rept. No. 155, Contract VT/6702, AF 33(657)-15919, Teledyne Industries, Inc., Earth Sciences Div., Alexandria, Va., 1966.

VESIAC 14,822 VU
AD 486 405

Theory of coherency analysis of noise at seismic arrays is described and illustrated by a synthetic example. The theory is applied to data from a couple of arrays, CPO in Tennessee and a LASA subarray in Montana. Ordinary coherency is shown to be inadequate to describe many multi-input, single-output systems. Partial coherency can be descriptive but may be computationally unstable. Multiple coherency is computationally stable and provides a measure of the number of sensors necessary in an array to adequately describe the coherent noise power.

DEAN, W. C., R. H. SHUMWAY, and C. S. DURIS, Best Linear Unbiased Estimation for Multivariate Stationary Processes, Sci. Rept. No. 207, Contract VT/6702, F33657-67C-1313, Teledyne, Inc., Alexandria, Va., 1968.

VESIAC 17,992 VU

The general linear hypothesis is formulated for a multivariate stationary stochastic process. The best (minimum variance) linear unbiased estimates are derived for the regression functions and it is shown that many signal estimation problems are special cases of the general linear model. Several examples are presented illustrating the technique for particular multivariate processes.

DEAN, W. C. and H. P. THIELMAN, Generalized Laguerre Functions, Section IV, Contract No. AF 49(638)-1117, United ElectroDynamics, Inc., Alexandria, Va., 1963.

VESIAC 6851 VU

A simple recursion formula is given for obtaining the Lapiace and Fourier transforms of generalized Laguerre functions. On the basis of Parseval's theorem, the obtained Fourier transforms, which are rational functions, are shown to be orthogonal and normalized over the entire real axis. It is also shown that the Laplace functions yield a simple way for designing an analog circuit for generating these Laguerre functions. A block diagram of this circuit is given.

DE BREMAECKER, J. C., Possibilities and Limitations of the Direct FM Seismographs, VESIAC Rept. No. 4410-77-X, Univ. of Michigan, Inst. of Sci. & Tech.. Ann Arbor, Mich., 1964.

VESIAC 8865D VU
AD 452 161

Examined are the advantages and the limitations of each component of the direct FM system. Also given is a typical example of the use of this system. The scheme used is briefly reviewed: it is the familiar push-pull capacitor transducers method. The heterodyned frequency is counted and constitutes the digital output. It also is converted into a voltage which drives two feedback circuits, one which greatly attenuates the very low frequencies, and one which does the same thing for the very high ones. The first one is an amplifier with an RC network having a very long time constant; the other is another amplifier and a high-pass filter. Described is the voltage variable capacitor driven by the latter.

DEFANTI, D. J., J. E. SPENCE, Love Wave Diffraction in a Variable Thickness Surface Layer, Rept. No. AFCRL 65-155, Contract AF 19(628)-319, University of Rhode Island, Kingston, R. I., 1965.

VESIAC 11,430 VU
AD 617 148

Consideration is given to the mixed boundary value problem of Love wave propagation in a solid layer over a solid half-space where the layer undergoes an abrupt change in thickness. Both the layer and half-space are considered to be homogeneous elastic media. Interest is focused on the amplitudes of the transmitted and reflected Love waves relative to the magnitude of the excitation. Using a function-theoretic argument based on the Wiener-Hopf technique integral expressions for the total fields are obtained. The transmission and reflection coefficients are then extracted by a standard appeal to the calculus of residues.

DEFENSE ATOMIC SUPPORT AGENCY (STAFF), Project LONGSHOT - Report of Operations, Project VELA UNIFORM, Final Rept. No. VUF-2701, Contract: Agency Document, Defense Atomic Support Agency, Wash., D. C., 1967.

VESIAC 17,625 VU
AD 818 991 L

The climax of Project LONGSHOT came at 2100 hours GMT, 29 October 1965, when the 80-kt device was detonated at a depth of 2,300 feet below the surface on Amchitka Island (Aleutian chain), Alaska, at about 51° 21' 17" north latitude and 179° 10' 57" east longitude. Accomplished to provide seismological data for use in improving our nation's capability to detect, locate, and identify underground nuclear tests, the event was announced prior to shot time so that special and regular seismographic stations throughout the world could prepare for and record the related signals. The advanced preparation, along with the high yield and apparently excellent coupling of energy, resulted in an abundance of exceptionally good seismographs, many at great distances.

VESIAC 14,831 VU
AD 637 601

DEHLINGER, P., Investigations on the Seismicity and Crustal and Subcrustal Structures in Oregon, Final Report, Rept. No. AFCRL-66-478, Contract AF 19(628)-2778, Oregon State Univ., Corvallis, Oregon, 1966.

This project concerns an investigation of the seismicity and the nature of the crustal and subcrustal structures of the Pacific Northwest. It involved studying seismograms from local earthquakes recorded at stations in the Pacific Northwest states, developing local travel-time curves for Oregon and adjacent regions, studying surface wave dispersion travelling across the northwest states and determining crustal structures from the dispersion. A special seismic station was established at Klamath Falls, Oregon, to aid in this study. Results of the project are given, and work which should be undertaken in the future is described.

VESIAC 6559 VU

DEHLINGER, P. and J. W. BERG, Seismicity of Oregon, First Semiannual Tech. Rept., Contract No. AF 19(628)-2778, Oregon State College, Corvallis, Oregon, 1963.

The objectives of the project are to investigate variations in crustal and subcrustal structures in and surrounding Oregon, to investigate the seismicity of Oregon and off the Oregon coast, to determine velocities of different seismic waves orginating from local earthquakes and quarry blasts, to investigate methods of determining focal depths of local quakes, and to study surface wave dispersion, background noise, and other phenomena. During the first six months, a small vertical Benioff seismometer was purchased; the Portland earthquake of November 6, 1962 was studied; travel time curves for Oregon and surrounding regions were constructed. Four curves were constructed because of Pn wave velocity variation.

VESIAC 14,322 VU

DEHLINGER, P., and J. W. BERG, Seismicity of Oregon, Third Semiannual Technical Report, Contract AF 19(628)-2778, Oregon State Univ., Corvallis, Oregon, 1964.

This is the third semi-annual technical report, covering the period 15 March to 15 September 1964, on the project "Investigations on the Seismicity and Crustal Structure in Oregon." Presented is a discussion of accomplishments of the reporting period, which were: (1) Further investigation of the nature of subcrustal materials in the Pacific Northwest; (2) Studies of the nature of the wave arriving 1 to 8 sec after P_n; (3) Investigations of surface wave dispersion in the pacific northwest; (4) Compiling and sending out of seismological bulletins of earthquake recordings made at the Corvallis and Klamath Falls stations; and (5) Operating the standard seismograph station at Corvallis and the seismic station at Klamath Falls.

DEHLINGER, P., and J. W. BERG, Seismicity of Oregon, ARPA Order No. 292-62, Contract AF 19(628)-2778, Oregon State Univ., Corvallis, Oregon, 1965.

VESIAC 10,133 VU

This fourth semi-annual report, covering the period September 15, 1964 to March, 1965, describes the progress made on the various facets of the project entitled, "Investigations on the Seismicity and Crustal Structure in Oregon."

DELIBASIS, N. and A. G. GALANOPOULOS, Space and Time Variations of Strain Release in the Greek Area, Contr. No. AF 61(052)-803, Natl. Observ. of Athens, Athens, Greece, 1964.

VESIAC 8757 VU

Six cross-sections show the latitude and longitude variations of the total strain released by all earthquakes of magnitude $\geq$ 4 3/4 occurred in the Greek area bounded by the parallels of 34°N and 42°N and the meridians of 19°E and 29°E during the period 1841-1959, and the cumulative magnitude corresponding to the total strain released in the eastern and western section, bounded by the 24°E meridian, over the 120-year interval 1841-1960 in dependence of time. Verified was the presence of an oscillation pattern with two migration cycles of the maximum of strain release between the two sections. Oscillation period and amplitude are given.

DENISON, R. E., Variations in Basement Rocks in Texas and Oklahoma, VESIAC Rept. No. 4410-75-X, Contr. No. SD-78, Univ. of Michigan, Inst. of Sci. & Tech., Ann Arbor, Mich., 1964.

VESIAC 8217 H VU

The author reviews what is known about basement rocks in Texas and Oklahoma, using the materials of the Univ. of Texas' Crustal Studies Lab. New information has been integrated with early work, and a means for isotropic age determinations on the major rock subdivisions have been provided. This study of basement rock demonstrates considerable variations in age, configuration, form, distribution, and lithology, which in turn cause anomalies in geophysical observations. The significance of basement rock variations in affecting regional surface seismic travel times has yet to be evaluated.

DENNEN, R. S., Synthesis of Rock Hugoniots, Final Rept., DA 49-146-XZ-237, IIT Res. Inst., Chicago, Ill., 1965.

VESIAC 13,011 VU

Methods of obtaining the Hugoniot equation of state were investigated. Several of these, employing high explosive devices, were used to obtain Hugoniot data for mineral samples common to many igneous rocks. Analytical synthesis models were constructed and used to determine the synthesized Hugoniot equations of state for granodiorite, gabbro and dunite. These compared favorably with existing Hugoniot data for similar materials. Methods were also developed and used to predict, roughly, Hugoniot curves for other geological composites for which no experimental data are presently available.

VESIAC 6515 VU
AD 437 382

DE NOYER, J., Crustal Reverberations and Possible Aftershocks as Identification Parameters for Earthquakes, Contract SD-50, Inst. for Defense Analyses, Wash., D. C., 1963.

An autocorrelation technique is suggested for measuring the rate of decay of near-source reverberations for P waves and searching for surface reflections and small aftershocks. Near-source reverberations may be related to depth of focus. If this hypothesis proves to be true, an additional method of focal depth estimation may contain sufficient information to determine the presence of the pP phase and of the P waves from aftershocks following the initial event by only a few seconds. The ability to identify either of these two types of arrivals can be considered diagnostic of earthquakes.

VESIAC 9296 VU

DE NOYER, J., Detection and Identification of Underground Nuclear Explosions by Seismic Methods, Contract AF 49(638)-1170, Inst. of Sci. & Tech., Univ. of Mich., Ann Arbor, Mich., 1964.

The problem of detecting and identifying underground nuclear explosions by seismic methods has many difficulties. Progress has been possible through an orderly improvement of seismological facilities and analysis methods. Continued improvements in the seismic capability for this problem appear possible.

VESIAC 8128 C VU
AD 441 592

DE NOYER, J., The Determination of Energy in Seismic Waves, VESIAC Rept. No. 4410-71-X, Contr. No. SD-78, Univ. of Michigan, Inst. of Sci. & Tech., Ann Arbor, Mich., 1964.

Although attempts have been made to relate the total energy in earthquakes to magnitude, reliable data on which to base such relationships are very scarce. However, present seismology capabilities should permit much more accurate estimates of wave energy. A number of improvements could be obtained as a result of developments in observational seismology, theoretical seismology, and computer technology. This should be done, as a method of investigating earthquake source mechanisms and properties of propagation paths, as well as for finding better magnitude-energy relationships. Recent crude estimates of seismic wave energy illustrate some interesting problems that can be studied by using energy determinations.

VESIAC 7077 VU
AD 437 381

DE NOYER, J., Identification of Earthquakes and Underground Nuclear Explosions by Seismic Methods, Contract SD-50, Inst. for Defense Analysis, Wash., D. C., 1963.

A number of seismic methods are discussed that have been proposed or investigated for the purpose of distinguishing between underground nuclear explosions and earthquakes. It is not possible to give a rigorous evaluation of each method at the present stage of investigation of these techniques. The discussions do include some of the author's opinions concerning relative values of the concepts considered.

DE NOYER, J., Operation and Characteristics for Seismic Detection in an Intermediate-Depth Borehole at The University of Michigan's Botanical Gardens, Rept. No. 4410-83-X, Contract SD-78 (ARPA), Inst. of Sci. & Tech., Univ. of Mich., Ann Arbor, Mich., 1964.

VESIAC 8884-A VU
AD 452 596

Both horizontal and vertical seismometers were operated at a depth of 1208 ft in an intermediate-depth borehole. Microseismic noise reduction was negligible at frequencies below 0.8 cps; microseismic noise at frequencies above 2 cps was reduced by a factor of about 10. Surface waves from both explosive sources and microseisms showed about the same attenuation with depth. Interference from the surface reflection of P waves produced a pronounced low in signal levels at 2.5 cps.

DE NOYER, J. M., G. E. FRANTTI, and D. E. WILLIS, Notes on Underwater Sound Measurements from the Lake Superior Experiment, AF 49(638)-1170, Institute of Science and Technology, University of Michigan, Ann Arbor, Mich., 1966.

VESIAC 13,493 VU

Underwater sound recordings of the Lake Superior shots showed that the predominant energy was contained in a band between 60 and 250 cps. Late arrivals were found that correlate with reflections from the main shore line, numerous islands and a few prominent shoals. By recording on magnetic tape and by using various pass-band filters on the laboratory playback, it was found that more precise times could be determined for the water wave arrivals.

DE NOYER, J. M., and D. E. WILLIS, Collection and Analyses of Seismic Wave Propagation Data, Fifth Semiannual Tech. Summ. Rept., 1 May Through 30 October 1964, 05178-38-L, Contract AF 49(638)-1170, Univ. of Mich., Inst. of Sci. & Tech., Ann Arbor, Mich., 1964.

VESIAC 10,411 VU

This report is a technical summary of the research in seismic wave propagation studies performed on this contract for the period 1 May through 30 October 1964. Included are reports on these fields of research: (a) technical reports, publications, and presentations; (b) field measurements; (c) attenuation measurements; (d) Lake Superior hydrophone data, (figures are included here); (e) seismic energy measurements; (f) optical processing; (g) new photographic recorder, (a photograph accompanies this section); (h) differentiation of linear and elliptical motion; (i) phase equalization studies; (j) source radiation studies; (k) equipment purchases, design and construction; (l) future work; (m) action required by ARPA and AFOSR, and (n) fiscal information.

DE NOYER, J. M., and D. E. WILLIS, Collection and Analysis of Seismic Wave Propagation, Sixth Semiannual Tech. Summ. Rept., 1 November Through 30 April 1965, Rept. No. 5178-50-L, Contract AF 49(638)-1170, Univ. of Mich., Inst. of Sci. & Tech., Ann Arbor, Mich., 1965.

VESIAC 10,664 VU

This report is a technical summary of the research in seismic wave propagation studies performed during the reporting period. Included are: (a) information on several NTS events recorded at portable seismograph stations in Southern Michigan; (b) attenuation and spectral studies on U.S.G.S. shots fired in Lake Michigan, and elsewhere; (c) reports on optical processing; (d) reports on mode filtering study by Fourier techniques; (e) a progress report on phase equalization studies. Reported on is a digital operator for equalizing seismic records to interstation differences; and (f) a survey of work to be carried out in the next six months.'

DE NOYER, J. M., D. E. WILLIS and J. T. WILSON, Measurements of Near and Regional Earthquakes Outside the Continental United States, Contract Nos., AF 19(604)-8809, AF 49(638)-1170, Univ. of Mich., Inst. of Sci. & Tech., Willow Run Labs., Ann Arbor, Mich., 1963.

VESIAC 6487 VU

A field measurement program was conducted in a number of areas outside the continental limits of the U. S. as a part of a research study on the propagation of seismic waves generated by earthquakes. Where these measurements were made is discussed. Over 250 earthquakes, as detected by short-period three-component seismometers, were recorded on FM magnetic tape recorders. Detailed frequency analyses were made for 120 of these recordings. The spectral data varied among areas for earthquake of comparable size and magnitude. Seismic energy of earthquakes is discussed for various locations, in relation to epicentral distances. Sizes of shear-surface waves in amplitudes is compared to amplitudes of compressional waves.

DER, Z. A., E. J. DOUZE, and A. W. SIMMONS, Deep Well Array Operations, Final Rept., 1 March 1967 to 31 May 1968, Rept. No. TR 68-24, Contract VT/7703, F33657-67C-1224, Teledyne Indust., Inc., Geotech Div., Garland, Texas, 1968

VESIAC 18,508 VU
AD 836 284

A deephole array consisting of 12 short-period triaxial seismometers was operated at a test site near Grapevine, Texas (GVTX) until 23 February 1968. The information gathered from the short-period triaxial array at the GVTX site was used to study short-period noise and signals, to develop signal enhancement, and filtering techniques. Most of the time was used in trying techniques based on least-mean-square filtering. In general, it can be concluded that because the noise is not stationary, these filters degrade too rapidly to be of practical interest for online processing. Several non-optimum filtering techniques were also tried and were found to be as effective as the optimum filters.

DERJAGUINE, B., "Propagation of Elastic Waves in Nonideally Elastic Media," Beitr. Angew. Geophys., Vol. 4, pp. 452-469, 1934, (Translated from Russian), Contract SD-78.

VESIAC 9525 VU

The theory of elastic after-effect, according to the Boltzmann concept, is the only theory confirmed by experience on the attenuation of vibrations with frequencies of 0.1 to 40,000 cps. When applied to elastic wave propagation, it furnished these results, in agreement with the data of seismology: (a) the coefficient of attenuation for waves not too short is inversely proportional to wave length; (b) the transverse waves are attenuated as they travel at a rate four times greater than that of longitudinal waves; (c) body waves exhibit an anomalous dispersion; (d) pulse propagation must be accompanied by its divergence; (e) the preceding conclusion is obtained independent of the special form of the theory, being the consequence of the principle of the conservation of the quantity of motion.

DERKACHEV, A. A., "A Method of Calculation of Seismic Effects with Standard Accelerograms," Akad. Nauk. SSSR. Sovet po Seysmologii Byull, No. 14, pp. 69-76, 1963, (Translated from Russian), Contract DA-49-083 OSA-3137.

VESIAC 7357 VU

A solution is given for the problem of seismic stress on a structure; however, to put this solution into practice it will be necessary to explore the possibilities of modern computer techniques and earthquake registration techniques.

DEVANE, J. F., (S. J.), Evaluation of Seismic Instruments and Basic Research on Seismic Wave Propagation, Semiannual Tech. Rept. VII, 1 September 1964-28 February 1965, Contract AF 19(628)-212, Weston Observatory, Weston, N. J., 1965.

VESIAC 10,305 VU

This report describes the progress made by Weston Observatory in evaluating seismic equipment and in noise studies using the New England Seismic Array data. Included in the evaluation is a computer for on-line computation and processing of technical data and a playback system for magnetic tapes. Equipment has been obtained for determining the photoelastic stress in models.

DEVANE, J. F., (S. J.), Evaluation of Seismic Instruments and Basic Research on Seismic Wave Propagation, Final Sci. Rept., 1 Sept. 1961 to 31 May 1965, Rept. No. AFCRL-66-476, Contract AF 19(628)-212, Boston College, Chestnut Hill, Mass., 1966

VESIAC 19,541 VU
AD 637 941

Facilities for testing seismic instrumentation of interest to TSL, AFCRL were developed. A measuring program, using dynamic photoviscoelastic methods, was conducted with the aim of determining the complete rheo-optical characterization of HYSOL (a urethane rubber compound).

A data analysis center, capable of sophisticated analysis of seismic data was assembled. A preliminary investigation of the time- and space-stationary statistical characteristics of seismic noise was made.

Three complete seismic instrumentation packages for use in seismic field studies were constructed. Some features of the seismicity and the crustal structure of New England were investigated.

Early stages of the brittle shear fracture process were studied in modeled arrays of cracks. Seismic pulses were emitted during each early crack-growth stage, and appreciable increases of applied stress above preceding crack-growth stress were required for further crack growth before crack coalescence could be attained. These results possibly explain some of the microseismic and foreshock activity observed in earthquake phenomena.

DEVANE, J. F., (S. J.), Evaluation of Seismic Instruments and Basic Research on Seismic Wave Propagation, Final Rept., 1 September 1961 to 31 May 1966, Rept. No. AFCRL-66-476, Contract AF 19(628)-212, Boston College, Chestnut Hill, Mass., 1966.

VESIAC 14,959 VU
AD 637 941

Facilities for testing seismic instrumentation of interest to TSL, AFCRL were developed. A measuring program, using dynamic photoviscoelastic methods, was conducted with the aim of determining the complete rheo-optical characterization of HYSOL (a urethane rubber compound). Also, a data analysis center, capable of sophisticated analysis of seismic data, was assembled. A preliminary investigation of the time- and space-stationary statistical characteristics of seismic noise was made. In addition, three complete seismic instrumentation packages for use in field studies were constructed. Further, the seismicity and crust of New England were studied. Finally, some results are given for early stages of the brittle shear fracture process which were studied in modeled arrays of cracks.

DE VISINTINI, G., Preliminary Results on Travel-Time Anomalies in the Alpine Arc, Contract AF 61(052)-786, Osservatorio Geofisico Sperimentale, Trieste, Italy, 1966.

VESIAC 13,999 j VU
AD 644 731

The travel-time anomalies of seismic waves crossing the Alpine Arc are investigated. The methods used for detecting these anomalies and the reliability of the results are discussed, and some suggestions are made on improving quantitative analysis of the data.

DE VISINTINI, G., Seismic Anomalies in the Alpine Arc, Annual Report, Contract AF 61(052)-786, Osservatorio Geof. Sperimentale, Trieste, Italy, 1965.

VESIAC 11,995 VU

The traveltime anomalies of seismic waves crossing the Alpine Arc are put in evidence and investigated. The methods used for detecting them and the reliability of the results are discussed, and some suggestions are drawn out in order to improve the quantitative analysis of the data.

DE VISINTINI, G., and C. MORELLI, Seismic Anomalies in the Alpine Arc, Annual Progress Report, Contract AF 61(052)-786, Osservatorio Geofisico Sperimentale, Trieste, Italy, 1966.

VESIAC 14,328 VU

This report describes the activity of the Seismic Research Group of the Osservatorio Geofisico Sperimentale of Trieste during the first two contractual years (February 1, 1964 - January 31, 1966) and shows the extension to the work planned for the near future. The main purpose of the research is to find and study the travel-time, frequency, and amplitude anomalies of seismic waves recorded in European observatories and caused by the influx of the Alps. Discussed are: (a) travel-time anomalies from ISS data; (b) mapping of the main crustal discontinuities; and (c) local earthquakes.

DI FILIPPO, D., "The Earthquake of the Azores Islands of November 25, 1941," Annali di Geofisica, Vol. 2, No. 3, pp. 400-405, July 1949, (Translated from Italian), Contract DA 49-083 OSA-3137.

VESIAC 14,374 VU

The first part of the study of the strong earthquake of the Azores Islands of November 25, 1941, is presented, reporting, together with the macroseismic data, the values of the epicentral coordinates and the origin time, calculated in geocentric coordinates, by applying the Caloi-Peronaci method to the data of 36 stations.

DI FILIPPO, D., and L. MARCELLI, "On the Initial Motion of the Seismic Waves Recorded in Rome During the Period of 1938-1943," Annali di Geofisica, Vol. 2, No. 4, pp. 589-606, October 1949, (Translated from Italian), Contract DA 49-083 OSA-3137.

VESIAC 14,380 VU

A statistical study was made on the nature of the first arrival of earthquakes recorded in Rome in the period of 1938-1943, with particular attention to Italy and the immediately surrounding zones up to a distance of 1000 km from Rome.

DI FILIPPO, D., and L. MARCELLI, "The "Magnitude" of Earthquakes and Its Determination at the Rome Seismic Station," Annali di Geofisica, Vol. 2, No. 4, pp. 486-492, October 1949, (Translated from Italian), Contract DA 49-083 OSA-3137.

VESIAC 14,376 VU

The research carried out on the magnitude of normal earthquakes is briefly summarized. The determination of a formula valid for the Rome seismic station is presented and the results obtained in a few applications are compared with those of Pasadena and Strasbourg.

DI FILIPPO, D., and F. PERONACI, "The Seismicity of the Faulted Field of Aterno," Annali Di Geofisica, Vol. 27, No. 1, pp. 195-210, 1964, (Translated from Italian), Contract SD-78.

VESIAC 9465 VU

After determining the epicentral coordinates, the origin time, the depth and the time-distance curves of the L'Aquila earthquake of June 24, 1958, the physical nature of the shock at the hypocenter is examined, resulting in a profile. The comparison between the seismicity, the geological and the tectonic nature of the Aterno valley with the results of the microseismic study furnish a probable explanation for the "faulted field."

DOBBIE, C. B. and S. R. HAMILTON, Subsurface EM Measurements on Project GNOME, Contract No. VT/197, AF 33(600)-42403, Edgerton, Germeshausen & Grier, Inc., Boston, Mass., 1963.

VESIAC 6171 VU

Edgerton, Germeshausen and Grier conducted a program of electromagnetic (EM) signal measurements during the GNOME event, 10 December 1961, to: 1) record low-frequency EM signals thought to be emitted as a result of underground nuclear detonation; 2) to analyze the waveforms and to determine the EM spectrum produced; 3) to determine the propagation characteristics of the geological strata encompassing the detonation. The EG&G detection and recording system was installed approximately 1,000 feet from surface ground zero. The system is described, as well as its calibration. The most sensitive channels, were so overloaded that the resulting waveforms had no meaning. Also, the B-field waveforms are described.

DODDS, J. G., A Direct Online Data Digitizing System, Contract No. 420-62, Univ. of Calif., San Diego, Calif., 1963.

VESIAC 7111 VU

This report describes an all-electronic system for digitizing analog data. Analog information recorded on magnetic tape in F. M. form can be played back directly through the digitizer, and then into the computer. In the present system, the tapes are played back on a Honeywell 8100 tape recorder. The signal from the digitizer, an eight-bit binary number, is sent to a Control Data Corporation 160A computer. When enough of these numbers are in storage, a binary record is written on the computer output tape. The output operation is buffered, so the flow of data into the computer is not interrupted. The resultant tape is in a format that can be read by a Fortran read statement.

DOHR, G., "Periods of the First Forerunners in the Seismograms of Gottingen," Ztschr. f. Geophys., Vol. 21, pp. 165-174, 1955, (Translated from German), Contract SD-78.

VESIAC 9535 VU

The P wave-trains recorded in Gottingen for North American earthquakes differ clearly from those for East Asian earthquakes.

DOHR, G., "Statistical Identification of Tides in Inland Waters, with the Example of the Bodensee," Ztschr. f. Geoph., Vol. 23, pp. 256-272, 1957, (Translated from German), Contract SD-78.

VESIAC 9818 VU

This paper examines the question whether statistical methods are adequate for the proof of tidal waves on inland waters. Similarly as in procedures for demonstrating tides of the atmosphere, the registrations of recording water gauges are subjected to harmonic analysis. The results are presented with the use of harmonic dials.

The statistical review of 274 days gives proof of the M_2- wave showing an amplitude of 0.4 mm on the water gauge at Konstanz. The material was submitted to a statistical error analysis and it could be shown that the value of 0.4 mm amplitude falls outside of the range of random variation and that no quasi-persistance is involved.

The method discussed appears to be suited for the identification of tides in inland waters.

DORMAN, H. J., Analysis of Seismic Data from the African Continent, Final Rept., 1 April 1966 to 31 March 1969, Contract AF 49(638)-1723, Lamont-Doherty Geol. Observ., Columbia Univ., Palisades, N. Y., 1970

VESIAC 20,172 VU
AD 705 660

A three-component high-gain, wide-band, long-period seismograph system was operated in Africa at Abeche, Chad. The installations provided high-quality recordings for many studies directly applicable to the VELA-UNIFORM program. This report gives a concise account of the work done at Abeche and the published results of that work.

DORMAN, J., and L. E. ALSOP. Seismic Wave Transmission Across Oceanic Areas, Final Rept., Contract Nonr 4259(12), Lamont-Doherty Geol. Observ., Palisades, N. Y., 1969

VESIAC 19,832 VU

The main areas of accomplishment under this contract were: 1) Theoretical and experimental studies of elastic wave propagation phenomena; 2) Implementation of satellite navigation data reduction computer programs in laboratory and shipboard computers.

DORMAN, L. M. and B. T. R. LEWIS, Experimental Isostasy, Part I: The Theory of the Determination of the Earth's Isostatic Response to a Concentrated Load, Contribution No. 232, Contract: F44620-68C-0087, Univ. of Wisconsin, Madison, Wisconsin, 1969

VESIAC 19,408 VU

In previous isostatic computations, the isostatic reduction of gravity data is made using an isostatic response function (the response of the earth's gravity field to a concentrated load on the earth's surface) derived for an assumed mechanism of compensation, e.g., Pratt, Airy. We give here a method for the computation of this function directly from observational data, eliminating the need for assuming a compensation mechanism.

If the response of the earth's gravity field to the loading of the topography is linear, the change in the gravity field due to this loading can be represented as the two dimensional convolution of the topography with the earth's isostatic response function.

DORMAN, L. M., and B. T. R. LEWIS, Upper Mantle Q and Transmission Studies Using LASA and WWSS Data, Annual Tech. Rept. No. 1, 1 June 1968 to 31 May 1969, Contract F44620-68C-0087, Univ. of Wisconsin, Madison, Wisconsin, 1969

VESIAC 19,747 VU

This report contains a summary of work dealing with the velocity and density structure under the Mo :ana LASA (Large Aperture Seismic Array). Principal results are 1) a new isostatic theory and results of its application to gravity and topographic data from the continental United States and 2) a differential time term (delay time) method of seismic analysis which can be used with a source whose origin time is unknown.

DOUGLAS, A., P-Signal Complexity and Source Radiation Patterns, Rept. No. 7885-1-X, Contract DA 49-083 OSA-3137, SD-78, Univ. of Mich., Inst. of Sci. & Tech., Ann Arbor, Mich., 1967.

VESIAC 15,915-N VU

This paper gives preliminary results of attempts to explain the complexity of the P signal in terms of Honda's type I and type II sources. These results show that the complexity is probably a crustal or near-surface effect at the source, but the exact cause is not yet clear. On simple theory it appears that the surface reflections pP and sP should be dominant over all other phases and thus give a majority of records in the complexity class U. Records with many arrivals of similar amplitudes are difficult to explain, unless it is assumed that the surface reflections are greatly attenuated near the source. The difficulty of finding surface reflections for many events suggests that this attenuation is real.

DOUZE, E. J., Short-Period Seismic Noise, Final Sci. Rept. No. TR 67-67, Contract AF 49(638)-1150, Teledyne, Inc., Geotech Div., Garland, Texas, 1968.

VESIAC 18,332 VU
AD 671 479

The purpose of this final report is to document the work done on the study of Short-Period Seismic Noise. Aside from the study of noise and signals, one of the chief aims of the Noise Study Program was to present findings at scientific meetings and to publish data in appropriate journals. Therefore, presentations and publications will be discussed in this report. Abstracts of all reports and papers are included as an appendix.

VESIAC 8869 VU

DOUZE, E. J., Spectral Analysis of Seismic Noise at Tabernacle Butte No. 1, Sublette County, Wyoming, Tech. Rept. No. 64-98, Contract AF 33(600)-43369, VT/1139, Geotech. Corp., Garland, Texas, 1964.

The power spectral density functions of seismic background noise were analyzed from a number of depths in the Tabernacle Butte No. 1, Sublette County, Wyoming. Results obtained indicated that various modes of Rayleigh waves and P-waves were responsible for the seismic noise. The third higher mode was the cause of the noise at 0.5-sec period.

VESIAC 8870 VU

DOUZE, E. J., Spectral Analysis of Seismic Noise at the Meridian Unit No. 1 Deep Hole, Eureka, Nevada, Tech. Rept. No. 64-99, Contract AF 33(600)-43369, VT/1139, Geotech. Corp., Garland, Texas, 1964.

The power spectral density functions of seismic background noise were analyzed from a number of depths in the Meridian Unit No. 1 deep hole. Simultaneous noise samples from two deep-hole seismographs and a surface seismograph were used. Results indicated that the noise for periods greater than 1.5 sec could be explained in terms of Rayleigh waves. The noise of periods less than 1.5 could be explained by a mixture of body waves and Rayleigh waves. Because of the complexity of the data, the types of waves present at periods less than 0.8 sec could not be identified.

VESIAC 8874 VU

DOUZE, E. J., Spectral Analysis of Seismic Noise at the Trigg No. 1 Deep Hole, Grapevine, Texas, Tech. Rept. No. 64-107, Project VT/1139, Contract No. AF 33(600)-43369, Geotech. Corp., Garland, Texas, 1964.

The power-spectral density functions of seismic-background noise were analyzed from a number of depths in the Trigg No. 1 deep hole, Grapevine, Texas. Results obtained show that the noise recorded by the vertical-motion seismograph can be explained by a combination of Rayleigh waves of fundamental and higher modes, and body waves.

VESIAC 8408 VU

DOUZE, E. J., Study of Short-Period Seismic Noise, Semiannual Tech. Summ. Rept., Contract No. AF 49(638)-1150, Geotechnical Corp., Garland, Texas, 1964.

The report presents results from studies of short-period seismic noise and signal levels. Preliminary investigations have been made to improve the signal-to-noise ratio by changing the frequency response of the instrumentation. Results of investigations of wind-generated noise show that rapid attenuation occurs at shallow depths. A study of variations in amplitudes of signals across a network of seismograph stations indicates that large amplitude changes can be expected. Periods of P waves are shown to increase with distance from the source. Teleseismic events have an average period of 1.0 sec.

DOUZE, E. J., Study of Short-Period Seismic Noise, Appendix I to Tech. Rept. No. 65-2, Tech. Rept. No. 64-135, Noise Attenuation in Shallow Holes, Contract AF 49(638)-1150, Geotech. Corp., Garland, Texas, 1965.

VESIAC 9438-A VU

Short-period seismograph recordings in shallow holes indicate that significant improvements in performance are sometimes obtained at shallow depths. Wind noise attenuates rapidly and becomes insignificant at depths less than 60 m. In the presence of low-velocity weathered layers, the normal background noise decays rapidly with depth and significant improvements in the signal-to-noise ratios are obtained.

DOUZE, E. J., Study of Short-Period Seismic Noise, Appendix 3 to Tech. Rept. No. 65-2, Tech. Report No. 64-132, Special Orientation Program, Phase I, Contract AF 49(638)-1150, Geotech. Corp., Garland, Texas, 1964.

VESIAC 9438-C VU

The basic objective of the program to assure that all students were qualified to perform the fundamental operations of a mobile seismological laboratory was achieved.

The limited time allowed in the contract for an equipment packing and moving demonstration and site setup exercises restricted the students' proficiency in these areas. These men will encounter difficulty in efforts to move and setup the first time. If possible, qualified Geotech technicians should be available to assist with moves that might be planned.

The students' attitude towards studying and apparent eagerness to learn were commendable.

Operation and maintenance manuals were not available for all equipment components. In these cases, corrected schematic diagrams, memoranda and other pertinent material were offered to students.

DOUZE, E. J., Study of Short-Period Seismic Noise, Semiannual Tech. Summ. Rept. No. 4, 1 July to 31 December 1964, Tech. Rept. No. 65-2, Contract AF 49(638)-1150, Geotech. Corp., Garland, Texas, 1965.

VESIAC 9438 VU

The report presents the results of studies of short-period seismic noise, signal levels, and signal-to-noise ratios. Section 2 describes the wave types present in the noise between periods of 1.0 and 6.0 sec. Section 3 describes the results of an experiment in optimum filtering. Appendices 1 and 2 are studies on the effect of seismometer burial and of topography on wind-induced noise. Appendix 3 describes an orientation course for foreign personnel conducted at the Geotechnical Corporation.

DOUZE, E. J., Short-Period Seismic Noise, Appendix I to Semiannual Tech. Summ. Rept. No. 7, TR No. 66-25, Contract AF 49(638)-1150, Teledyne Indust., Geotech Div., Garland, Texas, 1966.

VESIAC 13,962-A VU
AD 628 883

This report is a summary of studies conducted on short-period (6.0-0.3 sec) noise over a period of approximately three years. Information from deep-hole and surface arrays was used in an attempt to determine the types of waves of which the noise is composed. The theoretical behavior of higher mode Rayleigh waves and of body waves as measured by surface and deep-hole arrays is described. Both surface and body waves are shown to exist in the noise. Surface waves generally predominate at the longer periods (in the period range discussed) while body waves appear at the shorter periods at quiet sites. Not all the data could be interpreted.

DOUZE, E. J., Study of Short-Period Seismic Noise, Semiannual Tech. Summ. Rept. No. 8, 1 January to 30 June 1966, Rept. No. TR 66-80, Contract AF 49(638)-1150, Teledyne Industries, Inc., Geotech Div., Garland, Texas, 1966.

VESIAC 14,957 VU
AD 638 912

This report describes studies on S-P seismic noise. It includes sections on spectral moments, sources of microseisms, statistical analysis, and S-P surface waves.

DOUZE, E. J., Study of Short-Period Noise, Semiannual Rept. No. 9, Scientific, Interim June-Dec. 1966, Rept. No. TR 67-9, Contract AF 49(638)-1150, Teledyne Indust., Inc., Geotech Div., Garland, Texas, 1967.

VESIAC 15,527 VU

The data recorded at the four-seismograph array at Station Inge Lehmann, Greenland, shows that the noise is incoherent between seismographs at periods less than 1.5 sec. For periods greater than 1.5 sec, coherences are high. The velocities of the waves on the noise have not been determined. The detection capability of the site is discussed. A 17-element array is recommended if the array is to be expanded.

DOUZE, E. J., H. ROBERTSON, Study of Short-Period Seismic Noise, Tech. Rept. 65-77, Contract AF 49(638) 1150, Geotechnical Corp., Garland, Texas, 1965.

VESIAC 11,992 VU
AD 621 232

Described is work on S-P seismic noise, signals, and S-N ratios under Contract AF 49(638)-1150. The four parts of the report discuss: 1) statistical measurements of noise and some sampling techniques in use; 2) visual and spectral techniques that were used to detect body waves in the S-P noise recorded by a deep-hole array at Grapevine, Texas; 3) a filtered narrow-band seismograph that was designed to reduce noise outside the band of maximum signal information at Las Cruces, New Mexico; 4) higher-mode Rayleigh waves as recorded by deep-hole seismographs at Fort Stockton, Texas.

DOWLING, J. J., Travel-Time Curves from Velocity Distributions with Applications to the Earth's Upper Mantle (THESIS), 64-13,457, Contract AF 19(604)-7399, St. Louis Univ., St. Louis, Mo., 1964.

VESIAC 10,433 VU

A technique is developed for determining P and S velocities as a function of depth using body wave travel-times. It can be applied to a variety of velocity-depth functions, including continuous and discontinuous increases and decreases of velocity with depth. To do this T-D curves are calculated for an assured velocity distribution by evaluating the time and distance equations. These evaluations are valid for any velocity variation. This T-D curve is then compared to observed data. Adjustment in the model and re-calculation of the T-D curve is continued until an acceptable comparison between predicted and observed travel-times is achieved.

DOYLE, H. A., A. L. HALES, An Analysis of the Travel Times of S Waves to North American Stations, in the Distance Range 28° to 82°, Interim Sci. Rept. No. 3, Contract AF 19(628)-2936, Southwest Center for Advanced Studies, Dallas, Texas, 1967.

VESIAC 16,078 VU
AD 652 220

The travel times of S waves from 20 earthquakes to stations in North America in the distance range 28° to 82° have been studied. The deviations from J-B times were analyzed into station, source and distance components using the least-squares time-term approach of Cleary and Hales.

Within the distance range studied, large changes of the S travel times, such as were required by the lower mantle velocities proposed by MacDonald and Ness (1961), are not permitted by the present data. The analysis was checked by carrying out a univariate analysis of variance of the same data.

DRESSER ELECTRONICS (STAFF), Unmanned Seismic Station, Tech. Manual, Contract No. VT/1134, AF 33(657)-7120, Dresser Electronics, Houston, Texas, 1964.

VESIAC 7379 VU

This manual describes the general system, theory of operation, installation, maintenance, and troubleshooting of a complete Unmanned Seismic System for the detection, processing, and display of seismic phenomena occurring in the frequency range of 1 to 20 cycles per second.

DUBOURDIEU, G., "The Lesson of the Agadir Earthquake," Akad. Sci. Paris Comptes. Rendus, Vol. 256, No. 3, pp. 723-725, 1963. (Translated from French), Contract SD-78.

VESIAC 9414 VU

The Geological Service of Morocco has published several studies of earthquakes which occurred in Agadir on February 29, 1960. The data found correlate with certain findings on the recent tectonics of North Africa and the geographical distribution of earthquakes—findings made prior to the destruction of Agadir. Thus, we can draw a lesson from this information. This is the object of the present report, which was written for a practical purpose.

DUENNEBIER, F. K., Spectral Variation of the T Phase, Tech. Summ. Rept., Rept. No. HIG-68-22, Contract Nonr 3748(01), Univ. of Hawaii, Inst. of Geophys., Honolulu, Hawaii, 1968

VESIAC 19,266 VU

The frequency-time characteristics of the T phase are studied in an effort to isolate the properties of the abyssal T-phase generating mechanism. Early arrivals, or forerunners, are found to have the properties of an abyssally generated T phase. Abyssal T-phase generation is found not to be confined to regions of high latitude where the sofar channel is bounded by the ocean surface, but is found to also occur in southern latitudes where the sofar channel is bounded by a surface channel.

DUENNEBIER, F. K., R. H. JOHNSON, T-Phase Sources and Earthquake Epicenters in the Pacific Basin, Tech. Summ. Rept., Rept. No. HIG-67-24, Contract Nonr. 3748 (01), Hawaii Inst. Geophys., Univ. of Hawaii, Honolulu, Hawaii, 1967.

VESIAC 17, 301 VU
AD 663 569

Two years of T-phase source locations are compiled together with U. S. Coast and Geodetic Survey earthquake epicenters in the Pacific Basin for the same time period. It is shown that the T-phase sources have a higher density in regions which insonify the hydrophone array and an accuracy equivalent to or better than C&GS epicenters in regions where geometry is favorable, or where abyssal T phases are generated.

DUDA, S. J., The Stress Field Around a Fault According to a Photoelastic Model Experiment, Contr. No. AF 61(052)-588, Seis. Inst., Univ. of Uppsala, Uppsala, Sweden, 1964.

VESIAC 8641 B VU

A report is given of preliminary photoelastic measurements of the two-dimensional stress field around a fault or crack in a plate. The measurements include these cases: open slit with the uniaxial applied pressure field making an angle of 45° with the slit; closed slit (zone of weakness) with two different thicknesses of the weak zone and again 45° to the external pressure field; the measurements for the weakest slit were made also with an angle of 22.5° to the pressure field. The measured and calculated normal and shear stresses are represented in graphical form. The results provide explanations for some earthquake characteristics -- for example, distribution of shear stress and patterns of geographical extension of seismic activity during an aftershock sequence.

DUDA, S. J., Travel Times and Body Wave Magnitude, Sci. Interim Rept., Rept. No. 8, Contract AF 19(628)-5100, St. Louis Univ., St. Louis, Mo., 1970

VESIAC 20,400 VU

The Q-charts used presently for magnitude determinations were obtained mainly from direct observations of ground motion amplitudes of several components of seismic waves (e.g. PZ, PH, SH) as functions of epicentral distance.

A set of new Q-charts, obtained independently of direct amplitude observations, for PZ-, PH-, and SH-waves is presented. A refinement in the magnitude definition warrants the magnitude figures obtained with the new Q-charts to be uniform with regard to focal depth. Examples show the new Q-charts to decrease the scatter of magnitude determinations between stations.

Since the efficiency in generating longitudinal and transverse waves is most probably not the same for all events, separate P-wave and S-wave magnitudes are advocated.

DUDA, S. J., C. KISSLINGER, O. W. NUTTLI, and W. V. STAUDER, Research in Seismology, Final Sci. Rept., 1 Sept. 1965 to 31 August 1969, Rept. No. AFCRL-69-0409, Contract AF 19(628)-5100, St. Louis Univ., St. Louis, Mo., 1969

VESIAC 20,077 VU
AD 695 851

This report contains a summary and analysis of the results of research concerned with: (1) Focal mechanisms and the properties of seismic sources, including research on methods of determination and on the relation to regional and global tectonics in selected seismic zones; (2) Determination of the magnitude and the energy-release of earthquakes; (3) Effects of earth structure on wave propagation, including determination of the distribution of seismic velocities, travel-time curves and the effect of anisotropy; and (4) Model investigations of decoupling of explosions, and of seismic effects of explosions in prestressed and layered media.

DUDLEY, W. W., Jr., and L. D. MC GINNIS, Seismic-Refraction and Earth-Resistivity Investigation of Hydrogeologic Problems in the Humboldt River Basin, Nevada, Tech. Rept. No. 1, AFOSR-62-285, Univ. of Nevada, Reno, Nevada, 1962.

VESIAC 12,549 VU

Experiments with seismic refraction and electrical resistivity instruments were conducted in the vicinity of Winnemucca, Nevada, an area where the detailed geology is well known, to determine the value of these geophysical methods in ground-water studies. The seismic refraction method can be used to predict depth to bedrock and thickness of valley fill with considerable accuracy. Determination of the lithology and hydrologic characteristics of earth materials is less certain. Discussed is how the earth resistivity method may aid in interpreting lithology if used with sufficient control. Conjunctive use of the two methods can result in material reduction of the number and depth of test wells necessary for acquiring needed information.

DURBIN, W. P., JR., Comparison of Crustal Parameters with Geoid Undulations, VESIAC Rept. No. 4410-75-X, Contr. No. SD-78, Univ. of Michigan, Inst. of Sci. & Tech., Ann Arbor, Mich., 1964.

VESIAC 8217 G VU

The Aeronautical Chart and Information Center has conducted a study to resolve the wide disparity among geoid representations and give physical significance to the mathematics involved. In this report, the author presents the results of that study and explains the procedures which were used. By doing so, he hopes that its significance in crust and mantle studies can be appreciated. Three geoids, the Columbus, Kaula, and World (Fischer), were selected for the study because they are current, cover the contiguous U. S., and represent three types of derivation — gravimetric, gravimetric-astro-geodetic, and astro-geodetic.

DUVALL, G. E., Propagation of Plane Shock Waves in a Stress-Relaxing Medium, Contract No. AF 49(638)-1086, Stanford Res. Inst., Menlo Park, Calif., 1963.

VESIAC 6258 VU

This paper demonstrates how the decay of an elastic precursor wave preceding a shock can be related to material relaxation from an elastic, nonequilibrium state toward one of equilibrium. The author utilizes shock wave measurements in quartzite and, for comparison, considers the theory of shock waves generated by a uniform pressure acting on the surface of a semi-infinite slab.

DUVALL, G. E. and R. C. ALVERSON, Fundamental Research in Support of VELA-UNIFORM, Semiannual Tech. Summ. Rept. No. 5, Contract No. AF 49(638)-1086, Stanford Res. Inst., Menlo Park, Calif., 1964.

VESIAC 7338 VU

The first task reported on is Thermodynamics of Uniaxial Compression in an Elastic-Plastic Solid. Three problems considered in shock compression studies are discussed: 1) the sources of irreversible work in the shock transition; 2) the determination and interpretation of the Rankine-Hugoniot curve in the p-v plane; 3) the proper form for the equation of state. Sections 1 through 4 are concerned with these problems. The other task reported on is Spherical Waves in an Elastic-Plastic Medium. Explained is the numerical method developed for the solution of the practical differential equations governing wave propagation in an elastic-plastic medium. Some of the numerical results are presented which have been obtained for wholly elastic behavior by the method described in the last report.

DUVALL, G. E., and R. C. ALVERSON, Fundamental Research in Support of VELA-UNIFORM, Final Rept., Contr. No. AF 49(638)-1086, Stanford Research Inst., Menlo Park, Calif., 1964.

VESIAC 8184 VU
AD 442 254

This report describes two operations: 1) the first, which studies the processes by which seismic waves are initiated in order to learn the effects of characteristic differences known to exist near the sources, attempts to overcome the difficulties in describing the development of the earthquake produced wave; 2) the second considers spherical waves in elastic-plastic media. All the work that has been done is surveyed, with the purpose of determining the effect and subsequent time history of the elastic responses of the earth measured in the far field. Five major results are given.

ECOLLAN, J., and Y. ROCARD, "Electromagnetic Signal of Underground Explosions," Comptes Rendus, Vol. 256, No. 1, pp. 237-239, 1963, (Translated from French). Contract SD-78.

VESIAC 9412 VU

The mechanism of an electromagnetic signal is reported which is the only important signal (regardless of how weak) in the case of a contained underground explosion.

EDWARDS, J. P. III, Cumberland Plateau Observatory, Quarterly Rept. No. 7, Project VT/6704, Contract AF 33(657)-14648, Texas Inst., Inc., Dallas, Texas, 1967.

VESIAC 16,726 VU

The work conducted during the period 1 February 1967 through 30 April 1967 is reviewed in this report. Activities during this period were directed primarily toward routine observatory operation, completion of all research tasks and preparation of special reports covering this work, and transfer of the observatory facilities and equipment.

EDWARDS, J. P., III., Multiple Array Processors, Final Rept., VT/5052, AF 33(657)-13904, Texas Instr., Inc., Dallas, Texas, 1965.

VESIAC 13,049 VU

This report describes the synthesis and evaluation of multichannel filters for the Uinta Basin Seismological Observatory. The filters were designed for use in two on-line multiple array processors (MAP).

A 19-channel and a 10-channel multiple array processor were designed, fabricated and installed at the Uinta Basin Seismological Observatory.

The 19-channel processor was equipped with 7 multichannel filters and 6 beam-steer outputs. These filters were designed for operation on various configurations of the subsurface 3-dimensional 16-element array.

The 10-channel processor was equipped with 3 multichannel filters and 6 beam-steer outputs. All were designed for operation on the 10-element surface planar array.

EDWARDS, J. P., III, Noise Analysis for Uinta Basin Seismological Observatory, Tech. Rept., VT/5052, AF 33(657)-13904, Texas Instr., Inc., Dallas, Texas, 1965.

VESIAC 12,912 VU

The contract has been directed toward the development of an on-line operational Multiple Array Processor (MAP) for the Uinta Basin Seismological Observatory located in Vernal, Utah. Design of the optimum processor requires knowledge of the noise field at Station location if maximum advantage is to be taken of available processing techniques. Presented are results of the analysis of the noise field at UBO conducted during the period 1 September 1964 to 30 June 1965. Given is when data used in this report were collected. Subsurface array data has also been used, collected from 25 to 30 March 1965. Also included are results obtained using data collected during January and February 1963 under AFTAC Project VT/1124.

EDWARDS, J. P., III, S. A. BENNO, R. D. BAUER, and G. CREASEY, Cumberland Plateau Observatory, Annual Rept. No. 2, Project VT/6704, Contract AF 33(657)-14648, Texas Inst., Inc., Dallas, Texas, 1967.

VESIAC 16,723 VU

Work under this project has been primarily directed toward improving the use of small diameter seismic arrays in the teleseismic event detection problem. During this last year the feasibility and effectiveness of on-line automatic detection processing was investigated through the evaluation of the CPO Auxiliary Processor. Other tasks included the continued evaluation of the MCF processor to determine the impact of Wiener signal extraction processing on the station detection capability, the continued multidimensional analysis of the CPO ambient noise field to verify noise properties affecting performance of the MCF processor, and the investigation of techniques designed to enhance visual presentation of seismic data.

EDWARDS, J. P., III, S. A. BENNO, and G. CREASEY, Evaluation of the CPO Auxiliary Processor, Sci. Rept. No. 5, Project VT/6704, Contract AF 33(657)-14648, Texas Inst., Inc., Dallas, Texas, 1967.

VESIAC 16,653 VU

The CPO Auxiliary Processor computes two classes of detection outputs, the Fisher analysts of variance statistic and the Wiener power statistic, and one class of identification output, the United Kingdom technique. These detection outputs were compared on-line against a fixed signal threshold level, providing a continuous real-time "yes-no" output for signal. However, the fixed-threshold detection levels were initially difficult to determine accurately and, once determined, it was found that they were highly non-ttme stationary. Adaptive threshold detectors incorporated into the Auxiliary Processor could overcome the non-time stationarity of the threshold detectors.

EDWARDS, J. P., III., S. A. BENNO, and D. P. GLOVER, Cumberland Plateau Observatory, Quarterly Rept. No. 6, 1 Nov. 1966 through 31 Jan. 1967, Contract VT/5054, AF 33(657)-14648, Texas Instruments, Inc., Dallas, Texas, 1967

VESIAC 16,060 VU
AD 813 077

Work conducted by Texas Instruments Incorporated from November 1966 through January 1967 under the Cumberland Plateau Observatory (CPO) contract is reviewed in this quarterly report. Efforts during this quarter have been directed toward observatory operations, hardware construction and on-line implementation, and Dallas-based supporting research.

EDWARDS, J. P., III, D. P. GLOVER, Cumberland Plateau Seismological Observatory, Quarterly Rept. No. 3, Contract VT/5054, AF 33(657)-14648, Texas Inst., Inc., Dallas, Texas, 1966.

VESIAC 14,315 VU
AD 480 372

Reviewed is the operational and research work conducted by Texas Instruments Inc. during November and December 1965 and January 1966 on the Cumberland Plateau Seismological Observatory (CPO). During this period, operation of the observatory has continued on a routine basis. High-quality seismic film and magnetic tape were recorded on an around-the-clock schedule with minimum station down-time. Improvement in the overall observatory maintenance configuration has been obtained. Normal station-conducted analysis and research tasks, and associated CPO research tasks are discussed. A special report on ambient noise studies, which is in preparation, is reported here.

EDWARDS, J. P., III, D. P. GLOVER, and S. A. BENNO, Cumberland Plateau Seismological Observatory, Quarterly Rept. No. 4, 1 May 1966 Through 31 July 1966, Contract VT/5054, AF 33(657)-14648, Texas Instr., Inc., Dallas, Texas, 1966.

VESIAC 15,179 VU
AD 803 184

This report reviews the operations and research work conducted by Texas Instruments during May, June, and July 1966 on the Cumberland Plateau Observatory (CPO) contract. Efforts have been toward routine observatory operations, Dallas station-conducted research tasks, and design and construction of a detection and identification digital processor. Operation during the period has continued on a routine basis. Magnetic tape and film data have been of high quality. The overall observatory maintenance configuration is good, and minimum station down-time has been reported as a result of a sound, continuing preventive maintenance program. Research has been on evaluation of the MCF processor, ambient noise studies, and detection processor simulation.

EDWARDS, J. P., III, D. P. GLOVER, and S. A. BENNO, Cumberland Plateau Seismological Observatory, Quarterly Rept. No. 5, 1 August Through 31 October 1966, Contract VT/5054, AF 33(657)-14648, Texas Instr., Inc., Dallas, Texas, 1966.

VESIAC 15,180 VU
AD 803 361

This report reviews the operations and research work conducted by Texas Instruments during August, September, and October 1966 on the Cumberland Plateau Observatory contract. Efforts have been directed toward routine observatory operations, Dallas and station-conducted research tasks, and construction and checkout of a detection and identification signal processor. Operation has continued on a routine basis. The overall observatory maintenance configuration has remained good with minimum station down time resulting from a continual preventive maintenance program. Research has concentrated on evaluation of the MCF processor, ambient noise studies, detection processor research, and improvement of visual data displays.

EDWARDS, J. P., III, D. P. GLOVER, and S. A. BENNO, Cumberland Plateau Seismological Observatory, Annual Rept. No. 1, 1 May 1965 Through 30 April 1966, Contract VT/5054, AF 33(657)-14648, Texas Instr., Inc., Dallas, Texas, 1966.

VESIAC 15,181 VU
AD 803 362

Texas Instruments has overall responsibility for the operation of the Cumberland Plateau Seismological Observatory (CPO) for the period May 1965 through April 1967. This report reviews the analysis, engineering, and research tasks performed during the first contract year, May 1965 through April 1966. During this period, routine operations and analyses have continued. Research tasks have been performed on travel-time studies and the cataloging of events by station personnel. Research at Dallas has included construction and installation of a digital multichannel filter processor, an ambient noise study, and signal-to-noise ratio studies. This report has two parts: (1) station operations and research; (2) research tasks conducted at the Dallas facility.

EISLER, J. D., Seismic Data - LONG SHOT, Tech. Rept., Contract AF 49 (638)-1363, Stanford Res. Inst., Menlo Park, Calif., 1966.

VESIAC 14,053 VU
AD 478 572

Vertical component ground motion was recorded at six locations in Alaska within 20° of Amchitka Island, the site of LONG SHOT underground nuclear explosions. Recording equipment assembled for this purpose was characterized by high signal-to-noise ratio capability and wide dynamic range. Arrival times of the emergent and impetus motion (ePZ and iPZ) were determined from the magnetic playbacks of the data. Amplitudes of the initial motion and the maximum of the P wave group were determined employing appropriate calibration procedures. There was considerable scatter in the maximum P amplitudes of displacement data, showing a trend toward larger displacement with larger epicentral distance. Discussed is a prominent wave group, reflected from the core.

EISLER, J. D., W. H. WESTPHAL, 1966 Lake Superior Seismic Experiment - Ontario-Quebec Refraction Profiles, Sci. Final Rept., Contract AF 49(638)-1740, Stanford Res. Institute, Menlo Park, Calif., 1967.

VESIAC 16,370 VU

As a part of EARLY RISE, Stanford Research Institute and Geotech Division of Teledyne Industries recorded the first arrival times and signal amplitudes of refracted compressional waves from 38 chemical explosions detonated in July of 1966 on the floor of Lake Superior.

From these measurements it was found that the upper mantle velocity determined from a least squares fit to the overall SRI and Geotech first arrival data is 8.50 ± 0.01 km/sec. The constancy of the upper mantle velocity suggests that the regional dip of the upper mantle-crust boundary is near zero and that the thickness of the crust is uniform.

ENESCU, D., "A Solution of the Prohlem of the Formation of Longitudinal and Transverse Waves by Means of Explosions," Rev. Roumaine Geologie, Geophysique, et Geographie, Ser. Geophysique, Vol. 8, pp. 29-34, 1964, (Translated from Russian), Contract DA 49-083 OSA-3137.

VESIAC 13,661 VU

On the basis of Love's solution of the wave equation and on the basis of the multipole theory, equations of the field of displacement are derived for a source composed of three dipoles, without moment of different intensities—a source equivalent to an assymetric explosion, a generator of P and S waves.

ENOCHSON, L. D., and J. C. BRADFORD, Numerical Experiments with Partial and Multiple Coherence, Rept. No. SDL 127, Contract VT/2037, AF 33(657)-12447, UED Earth Sciences Division, Teledyne, Inc., Alexandria, Virginia, 1965

VESIAC 12,862 VU

Computational experiments are described which test the usefulness of matrix frequency response and multiple coherence function analysis of seismic array data. The test case employed is the simplest multidimensional case, a two input-single output linear system. This simulates an array with one trace identified as an output and the other two considered as inputs.

Two basic parameters are computed from the data: (1) the transfer function which gives the form of the linear relation existing between a given input and the output, and (2) a coherence function (of an appropriate type) which gives the degree of applicability and accuracy of the transfer function estimate. The three types of coherence examined are ordinary, partial, and multiple. These linear system parameters have applications to the determination of the structure of a seismic noise field in terms of its major components and sources.

It is concluded that gain and phase of the transfer function can be accurately and reliably computed and that coherence functions serve as an indicator of the degree of usefulness of the linear relation. It was determined that partial coherence is a relatively sensitive and delicate computational parameter and fairly narrow bandwidths and long record lengths must be employed to reliably estimate this parameter.

ENOCHSON, L. D., R. H. SHUMWAY, Progress Report on the Partial Coherency Study, Rept. No. SDL 146, Contract VT/6702, AF 33(657)-15919, Teledyne Industries, Inc., Earth Sci. Div., Alexandria, Va., 1966.

VESIAC 14,830 VU
AD 632 959

This report, divided into two parts, discusses the partial coherence function as a quantitative measure of linear relationship between two variables. Under appropriate conditions, the partial coherence between two variables will provide a more pertinent measure of their relationshtp than will ordinary coherence functtons. Part One is concerned with the theoretical problem of determining the structure of seismic noise in an array of seismometers. Part Two is concerned with applying the theory to an actual array of setsmometers, located at CPSO.

ENTICKNAP, R. G., and R. V. WOOD, Jr., Large Aperture Seismic Array, Contract AF 19(604)-7400, Lincoln Lab., Mass. Inst. Tech., Lexington, Mass., 1965.

VESIAC 13,858-B VU
AD 648 415

The stgnals from each setsmometer tn LASA in analog form, balanced with respect to ground, flow through a well head amplifie and then by underground cable to an underground concrete vault. Twenty-ftve such setsmometers arranged tn a geometrical pattern, together with the electronics which sample and prepare the signals for transmission, consttute a subarray. There are twenty-one subarrays described here.

The report then concentrates on the following three subjects: (a) Signal Collection; (b) Communications and Control; and (c) Signal Recording.

EPINAT'EVA, A. M., "Longitudinal Seismtc Waves Traveling in Certain Real Layered Media," Trudy Inst. Fiziki Zemli, A. N. SSSR, No. 14, 6 pgs., 1960, (Translated from Russtan), Contract DA-49-083 OSA-3137.

VESIAC 16,136 VU

In this report, an attempt has been made to solve the problem, encountered tn setsmic surveytng, associated wtth refracted waves that correspond to tnterfaces wtth small veloctty differences and also with reflected and refracted waves recorded beyond the origin of the refracted waves.

EPINAT'EVA, A. M., "Secondary Shocks in Setsmtc Observattons." Izvest. Akad. Nauk, SSSR, Ser. Geofiz., No. 4, pp. 43-60, 1951, (Translated from Russian), Contract DA-49-083 OSA-3137.

VESIAC 6741 VU

A description is given of experiments to determine the dependence between the origin time of secondary shocks and their amplitude and the size of the charge Q and depth of the shot. Graphs of the dependence of the time ΔT between two successive shocks agree with the theory of vibrations of a gaseous sphere in a liquid when the effect of the interfaces (the surface of the water and the bottom of the reservotr) ts taken into constderatton. The ratio of the wave amplitudes corresponding to the secondary shock and the explosion diminishes with an increase of Q. When Q has small values, secondary shocks of greater magnitude than that of the explosion were observed.

EPINAT'EVA, A. M., "Some Results of the Analysis of Formulas for the Amplitudes of Refracted Waves," Trudy Inst. Fiziki Zemlt, Akad. Nauk, SSSR, No. 6, pp. 7-51, 1959, (Translated from Russian), Contract DA 49-083 OSA-3137.

VESIAC 15,719 VU

Formulas for the amplitudes of longitudinal refracted waves in the case of solid and ltqutd media with different types of sources (harmonic and pulse) are compared. The general distincttve features of the formulas are explained and analyzed. On the basis of expertmental data, changes are introduced in the methods of determining the exponent of the divergence function, the absorption coefficient and the difference in absorption coefficients.

EPINAT'EVA, A. M., "Some Types of Multiple Seismic Waves," Akad. Nauk SSSR Ser. Geofiz. Izvest., No. 1, pp. 23-36, 1956, (Translated from Russian), Contract SD-78.

VESIAC 6742 VU

Theoretical and experimental investigations are presented of the kinematic and dynamic characteristics of multiple reflected and reflected-refracted waves, the first reflection of which occurs from an interface located above the source of excitation of the pulses. The experimental and theoretical data are in agreement.

EPINAT'EVA, A. M., and V. CERVENY, "Reflected Waves in the Region of the Second Critical Point," Stud. Geophys. Geod., Vol. 9, No. 3, pp. 259-271, 1965, (Translated from Russian), Contract SD-78.

VESIAC 13,317 VU

The investigation of the characteristics of reflected and head waves at special points—the critical points of the time-distance curves of refracted waves—is of great importance for an understanding of the physics of the generation of the waves forming in real media, for a determination of the optimum methods of recording waves in these regions and for the development of methods of determining wave types and the parameters of media.

ERKMAN, J. O., Hydrodynamic Theory and High Pressure Flow in Solids, Final Rept., Contract No. DA-49-146-XZ-095, Stanford Res. Inst., Menlo Park, Calif., 1963.

VESIAC 6296 VU

A plane shock wave is induced in a target by hitting the target with a flying plate accelerated to a high velocity by a charge of explosive. The amount of attenuation of the shock wave is determined by observing the velocity of the free surface of the target. Shocks are attenuated more rapidly in Yule marble, Vacaville basalt, and alluvium than predicted by calculations based on the theory of hydrodynamics. Problems concerned with the measurement of the flatness of the flying plates, with the condition of the plates, and with the recording method are discussed. A computer code using the artificial viscosity method is used to calculate the flow induced in a target by the impact of a flying plate.

ERKMAN, J. O., Propagation and Attenuation of Shock Waves in Solids, Contract No. DA-49-146-XZ-095, Stanford Res. Inst., Menlo Park, Calif., 1963.

VESIAC 6790 VU

This work was undertaken to obtain experimental data which could be used to decide whether the hydrodynamic model, an elastoplastic model, or some other model, best describes the behavior of shock waves in some representative solids. Measurements were made of the motion given to a free surface of the solid by the reflection of the shock front from the free surface. The use of samples of progressively greater thickness gave information on the attenuation of a shock in the material being studied. How shock waves were produced is fully described. The results of the tests, illustrated graphically, are fully discussed, including attenuation of particle velocity of shock waves, and pressure relief in shock waves.

ESPINOSA, A. F., G. H. SUTTON, and H. J. MILLER, A Transient Technique for Seismograph Calibration-Manual and Standard Set of Theoretical Transient Responses, Spec. Rept. No. 4410-106-X, Contract AF-19(604)7376 SD-78, Lamont Geological Observatory, Palisades, New York, 1965.

VESIAC 13,114 VU
AD 474 262

A transient technique for seismograph calibration was developed and tested by a variety of methods. This technique makes practical the daily calibration of continuously recording seismographs without disturbing the instruments more than a very few minutes. It was tested and proved satisfactory relative to results of more conventional stead-state methods by using both digital and analog analyses of the output transients.

Output transients and the corresponding theoretical response curves have been calculated for 94 sets of instrument parameters. By comparison of the calculated output transients with experimental results it is possible to obtain the response of the instrument with considerable precision, quickly, and without computation.

EUBANKS, F. R., G. T. BAKER, Array Research, Special Report No. 11, Automated Mapping System, Contract VT/4053, AF 33(657)-12747, Texas Inst., Inc., Dallas, Texas, 1966.

VESIAC 14,316 VU
AD 480 371

A series of programs has been written for the IBM 7044 Computer and Calcomp Plotter to aid in the evaluation of potential array sites and in interpretation of data recorded at an array site. These programs utilize sets of worldwide geographic coordinates and array site coordinates and provide maps of various types including stereographic projections centered on the array site and a map of the world in vector k-space centered on the site.

EVERNDEN, J. F., and D. M. CLARK, Investigation of P Travel-Time Curve, Sci. Rept., Rept. No. 236, Contract VT/9706, F33657-69C-0913, Teledyne Industries, Inc., Alexandria, Va., 1969

VESIAC 20,290 VU
AD 872 607

By using a large number of LRSM stations and a number of earthquakes from all azimuths and the well controlled nuclear explosions, a study of the "P" travel-time curve reveals it to be nearly a series of straight-lines or legs throughout the total distance of about 105°. Time as well as amplitude residuals were determined for the stations used and were found to be acceptably consistent. Analysis of the variance of the several modes of handling the data of each leg is shown which is significant in indicating the relative probability of each model as an explanation of the observed data. The "F" statistic value, degrees of freedom, etc., are shown for each leg. The existence of real differences in "P" travel-times and thus of mantle velocity structure are illustrated indicating that the velocity varies as a function of azimuth.

The very close correlation between site geology and average noise level on signal amplitude is discussed as well as this effect on magnitude calculations.

In addition, a computed "B-factor" curve developed from this study is compared with Gutenberg's and one by Clawson of Geotech.

EVERTSON, D. W., A Quarterly Report of Progress under U. S. Coast and Geodetic Survey, Quarterly Status Rept. No. 7, Contract CGS-1198, University of Texas, Austin, Texas, 1965.

VESIAC 13,308 VU

Three solion universal seismometer units have been completed with improved features. An electronics package is included with each seismometer for response shaping and moderate voltage gain. WWSSN responses can be duplicated in each one. Earthquake recording was done at the Balcones Research Center subsurface vault. A small horizontal shake table is nearing completion. Electromagnetic pumping is being considered as an alternative calibration method. An equation of motion has been derived for the solion universal seismometer. Visits were made to the Geotech in Texas, to calibrate seismometers and to discuss design techniques to minimize thermally induced noises in seismometers.

EVERTSON, D. W., Report of Progress under U. S. Coast & Geodetic Survey, Contract CGS-1198, Status Report No. 9, Contract CGS-1198, Univ. of Texas, Austin, Texas, 1966.

VESIAC 14,973 VU

Although solions compare favorably with other pressure transducers as to full scale signal to self-noise ratio, the exceptional pressure sensitivity of a solion seismometer has led to an intensitive effort to discover the lowest permissible threshold pressure that self-noise will permit. Mechanisms that originate noise current in a solion have been considered. Unsteady natural convection, caused by density gradients at the electrodes, may explain the predominant noise generation in conventional solions operated with the axis vertical. This effect has been simulated by an electrical analog circuit using thermistors. Apparatus for observing solion output in the presence of a minimum of acoustic, thermal, or electrical disturbance was used to test 17 kinds of solions.

EVERTSON, D. W., Status Report No. 8 on Contract CGS-1198 for the Period 1 October 1965 Through 8 February 1966, Contract CGS-1198, Univ. of Texas, Austin, Texas, 1966.

VESIAC 14.637 VU

Three solion universal seismometer and amplifier units were delivered to the Seismic Laboratory, Albuquerque, New Mexico. Three fixed voltage gains and plug-in filter circuits enable the seismometers to duplicate closely the response of the WWSS. Solion transducer and frame noise limit the magnification in the long period mode. Present noise in the solion transducer may conceivably originate from current fluctuations, fluctuating electrolysis rate, breakdown of oxide insulation on the cathode masking plates, convection currents, or a combination of such causes. Steps will be taken in future work to provide a seismometer that will make the most of the capability of each component in its construction.

EVERTSON, D. W., R. S. ADAIR, and G. E. ENGLISH, Report of Progress Under U. S. Coast & Geodetic Survey, Status Report No. 10, Contract CGS-1198, Univ. of Texas, Austin, Texas, 1967.

VESIAC 15,721 VU

Measurements have been directed toward verification of the solion noise previously reported. From the study of the noise tests of solions, it is postulated that seismic motion transverse to the axis of symmetry in the solion causes almost as much output as does seismic motion parallel to the axis of flow. Further tests have verified that solions are sensitive to transverse motion and that the transducer transverse output is caused by fluid flow instead of by forced convection. Phase shifts of the solions were observed while obtaining the response points on the vertical shake table.

EVISON, F. F., Earthquake Wave Anomalies in New Zealand, Contract SD-78, Univ. of Mich., I. S. T., Ann Arbor, Mich., 1966.

VESIAC 13,999 b VU

Pn arrival times at New Zealand stations from 500 local earthquakes are analyzed by computer. Anomalies are related to station site, epicentral distance, and focal depth.

EVISON, F. F., The Polymorphic Transition as a Possible Earthquake Source, Rept. No. 7885-1-X, Contract DA 49-083 OSA-3137, SD-78, Univ. of Mich., Inst. of Sci. & Tech., Ann Arbor, Mich., 1967.

VESIAC 15,915-L VU

The phase-change hypothesis relates earthquake occurrence to a changing pressure-temperature environment, and hence primarily to vertical convection in the upper mantle and crust, including diastrophic uplift and subsidence. Rapid polymorphic transitions aided by metastability provide a likely source mechanism.

EWING, M., Establishment of a Long Period Seismograph Network Utilizing Magnetic Tape Recording, Semiannual Tech. Summ. Rept. No. 2, Contract No. AF 19(604)-8485, Lamont Geo. Observ., Palisades, N.Y., 1962.

VESIAC 5571 VU

This semiannual technical report, covering the period from 1 December 1961 to 31 May 1962, identifies the stations selected and the criteria used, describes very briefly the network instrumentation, and explains the various analysis techniques that were devised or utilized; simple filtering, inverse filtering, total energy, Fourier spectral analysis, axis rotation, and phase separation.

EWING, M., Research Directed Toward the Use of Long and Intermediate Period Seismic Waves for the Identification of Seismic Sources, Semiannual Tech. Rept. No. 1, 1 August 1964-31 January 1965, Contract AF 19(628)-4082, Lamont Geol. Observ., Columbia Univ., Palisades, N. Y., 1965.

VESIAC 9786 VU

During the period covered by this report research has been carried out on a variety of projects. Of particular interest to the aims of VELA UNIFORM is a study involving the relocation of two hundred earthquake epicenters from the Kamchatka-Kurile Islands region. It was found that most of the earthquakes occur offshore, and that the epicenters on land correspond in general to intermediate or deep-focus shocks, although several shallow-focus earthquakes did occur in Kamchatka. The SALMON underground explosion was well recorded although attempts to record at several unusual sites were not successful. A source mechanism study, utilizing Rayleigh waves only is discussed.

EWING, M., Research Directed Toward the Use of Long- and Intermediate-Period Seismic Waves for the Identification of Seismic Sources, Annual Tech. Rept. No. 1, Contract AF 19(628)-4082, Lamont Geoi. Observ., Palisades, N. Y., 1965.

VESIAC 12,664 VU

During the period covered by this report research has been carried out on a variety of projects. Of particular interest to the aims of VELA-UNIFORM is a study involving the relocation of two hundred earthquake epicenters from the Kamchatka-Kurile Islands region. In agreement with a previous Russian study, it was found that most of the earthquakes occur offshore, and that the epicenters on land correspond in general to intermediate- or deep-focus shocks, although several shallow-focus earthquakes did occur in Kamchatka.

The SALMON underground explosion was well recorded although attempts to record at several unusual sites were not successful. A source mechanism study, utilizing Rayleigh waves only, resulted in some ambiguity which was resolved by appealing to body wave data. This ambiguity could also have been resolved by good Love wave data if such had been available, but it is clear that with present techniques Rayleigh wave data only is insufficient for a unique source determination. Some of the other topics covered in this report are studies of P wave travel times in the shadow zone, dispersion data from PL waves and granddaddy waves, and PcP phases generated by nuclear explosions.

EWING, M., Research Directed Toward the Use of Long- and Intermediate-Period Seismic Waves for the Identification of Seismic Sources, Tech. Rept. No. 3, Contract ARPA Order No. 292, AF 19(628)-4082, Lamont Geol. Observ., Columbia Univ., Palisades, N. Y., 1967.

VESIAC 16,720 VU

Several studies of interest to the VELA-UNIFORM program have been completed or carried out during the reporting period. Among these, the study of the relative excitation of body and surface waves by explosions and earthquakes shows that while the two classes of events do not separate into two distinct categories, the explosions generate smaller surface waves than most of the earthquakes. Focal mechanism and aftershock studies have cast new light on our knowledge of the earthquake process. Seismicity studies, made possible only by the availability of digital data, may enlarge our ideas on the spatial and temporal distribution of seismic sources.

EWING, M., Semiannual Tech. Report No. 4, 1 January 1963 to 30 June 1963, Contract No. AF 19(604)-7376, Lamont Geol. Observ., Palisades, N. Y., 1963.

VESIAC 6890 VU

A general summary of the work completed to date on the phase velocity mapping project is given. New phase velocity data for the U.S. has just been obtained and is described in some detail. Also reported on are: 1) very precise phase velocities of Rayleigh waves in the period range of 200 to 3200 sec, obtained from free oscillation data; 2) a seismograph system with three-band rejection filter galvanometers which have been placed in operation; 3) a detailed study of epicentral locations in the South Pacific of over 100 earthquakes in the period 1957-1963; 4) a study of high-frequency seismic waves recorded in a mine at a depth of 1850 ft. below surface; and 5) an investigation of the earth's elastic strain.

EWING, M., Semiannual Technical Report No. 5, 1 July 1963-31 Dec. 1963, Contract AF 19(604)-7376, Lamont Geolog. Observ., Palisades, N. Y., 1964.

VESIAC 7509 VU
AD 432 363

Work on these subjects is reported: a) standard Russian and short-period instruments being installed at Lamont; b) a short-period instrument located 1800 feet below the surface that was operated in the frequency range between 2 and 100 cps with a response that was flat to velocity; c) a study made of the behavior of the excitation function with respect to time for 8 deep-focus earthquakes, 4 shallow-focus earthquakes, and the Hardhat explosion; d) the continuation of the study of radiation patterns from small magnitude earthquakes and explosions; e) a new method for obtaining dispersion curves for surface waves from the travel times of body waves; f) locating of earthquake epicenters.

EWING, M., To Study and Measure the Motion of the Deep Ocean Floor in the Frequency Range of Seismic Waves, Semiannual Tech. Rept., Contract No. AF 19(604)-8357, Lamont Geol. Observ., Palisades, N. Y., 1961.

VESIAC 5570 VU

This semiannual report provides a short comment on technical progress in the construction of ocean bottom seismograph systems and describes briefly scientific findings from three bottom seismograph stations. The oceanic compressional velocity structure measured by conventional marine refraction techniques was verified, and crustal and mantle shear waves were observed with velocities of 3.7 and 4.3 km/sec.

EZELL, G. D., The Application of Telemetry Techniques to Large Short-Period Seismometer Arrays, VESIAC Rept. No. 4410-74-X, Contr. No. SD-78, Univ. of Mich., Inst. of Sci. & Tech., Ann Arbor, Mich., 1964.

VESIAC 7743 VU
AD 436 447

This report describes problems, such as the effect of transmission-line length on seismometer damping, signal attenuation, and signal-to-noise ratio, which are associated with data transmission systems in use today. It gives general discussion of frequency and time-division multiplexing pulse code modulation, and electromagnetic wave transmission, and examines in more detail other transmission systems which are applicable to seismic data.

FAIRBORN, J. W., Station Correction at LASA, Contract AF 49(638)-1632, Mass. Inst. of Tech., Cambridge, Mass., 1966.

VESIAC 14,814 VU
AD 649 264

Two types of crustal and/or upper mantle lateral inhomogeneities are postulated; they are dipping layers, which have different seismic velocities, and an upper mantle-crustal model having a linear velocity gradient in the horizontal direction. The P-wave travel time deviations as a function of azimuth angle to the earthquake epicenter are calculated for each model and compared, on the basis of magnitude, with the azimuthally dependent part of station corrections observed at LASA and TFSO.

FARNHAM, P. R., A Study to Evaluate the Efficiency of Beamforming the LASA Long-Period Array, Sci. Rept., Rept. No. 226, Contract VT/6702, F33657-68C-0945, Teledyne Inc., Alexandria, Va., 1968

VESIAC 19,152 VU
AD 844 265

The long-period vertical-component data from 18 teleseismic earthquakes recorded at the Montana LASA were prefiltered and time-shifted to determine the amount of signal loss, rms noise reduction, and signal-to-noise ratio improvement which results from beamforming.

FARNHAM, P. R., and D. M. CLARK, Preliminary Evaluation of Norsar, Sci. Rept., Rept. No. 221, Contract VT/6702, F33657-68C-0945, Teledyne Indust., Inc., Alexandria, Va., 1968

VESIAC 19,034 VU
AD 840 268

A preliminary evaluation of NORSAR, using short-period data from one noise sample and two teleseismic events, was performed to determine: 1) the minimum inter-sensor spacing required to produce optimum rms noise reduction by summing, and 2) the amount of signal loss, rms noise reduction and signal-to-noise gain produced by beamforming the array.

FARNHAM, P. R., R. L. SAX, E. A. FLINN, and E. F. CHIBURIS, P Wave Parameters Measured at the Montana LASA, Sci. Rept., Rept. No. 217, Contract VT/6702, F33657-68C-0945, Teledyne Indust., Inc., Alexandria, Va., 1968

VESIAC 18,525 VU
AD 834 914

The raypath parameter, P, and the azimuth deviation of the source from the raypath direction have been computed from the first arrival P waves of over 600 earthquake events recorded at the Montana LASA during its first two years of operation. The epicenters of 247 of these events are located along a profile extending northwest of the reference station, LASA - A0, within the range of azimuth 300°-320°. The epicenters of 162 events are located along a profile toward the southeast in the range of azimuth 140°-160°.

FARRELL, P. J., Cumberland Plateau Seismological Observatory, Quarterly Rept. No. 1, Contract AF 33(657)-14648, VT/5054, Texas Instr., Inc., Dallas, Texas, 1965.

VESIAC 12,351 VU

Texas Instruments, Inc. formally assumed responsibility for operation of the Cumberland Plateau Seismological Observatory (CPSO) May, 1965. During the first three months of operation, routine analysis and operation of the station continued and specific research studies on ambient noise, signal-to-noise ratios and detection capability have been initiated. In addition, a digital multichannel filter unit is being built for installation early in 1966. A general description of the station instrumentation and operation is included in this quarterly report.

FARRELL, P. J., Ocean-Bottom Seismometer Data Collection and Analysis, Semiannual Tech. Rept. No. 5, Contract No. AF 19(604)-8368, Texas Inst., Dallas, Texas, 1963.

VESIAC 7018 VU

A total of 300 hours of ocean-bottom seismic data have been collected in areas off the California coast and north and south of the Aleutian Chain in varying water depths to 20,000 feet. Discussed are refraction data of Pn arrivals recorded at Adak and on the ocean bottom (from 1000-pound explosive sources in the water); detailed analyses of a near-regional event recorded simultaneously on land and on the ocean bottom in the vicinity of Cape Mendocino, California; analyses of land and ocean-bottom noise samples in the California area, indicating that at the microseismic peak the ocean-bottom average noise power levels are 20 db greater than at a nearby land station.

FARRELL, P. J., Special Report on Field Test of Texas Instruments Ocean Bottom Seismometer Unit at the Uinta Basin Seismological Observatory, Vernal, Utah, Contract AF 19(604)-8368, Texas Inst., Dallas, Texas, 1963.

VESIAC 5597 VU

Texas Instruments has constructed an automatic seismic monitoring and recording device which is described in this report. From 21 November to 12 December, inclusive, the ocean-bottom seismometer instrumentation operated unattended at UBO. Described in this report are: 1) the purpose of this operation, and 2) the manner in which the equipment was operated. Threshold control evaluation is also discussed, as well as the portion of the signal passed before the threshold tape, the period versus relative magnification curve of the O. B. system, and the length of the unattended operation. The report concludes that the station is capable of unattended operation for a minimum of 22 days.

FARRELL, P. J., 30-Day Ocean-Bottom Seismograph - Semiannual Tech. Rept. No. 1, Contract No. AF 19(628)-4075, Texas Inst., Dallas, Tex., 1964.

VESIAC 8349 VU

The 30-day unattended seismograph represents the result of three years engineering operation and research by TI on the problem of investigating ocean-bottom seismometry. Some advantages of these units over their predecessors are: 1) the ability to record on magnetic tape, unattended for 30 days versus 11 hours in the previous unit; 2) free fall and sonar recall versus lowering and raising by steel cable previously; 3) operation to 25,000 feet versus 20,000 feet previously; 4) continuous operation for 30 days on 50 lbs. of batteries; 5) the ability to insert WWV directly on the magnetic tape, allowing time recovery over a 40-day period to 1/10 seconds; 6) operation at tilt angles up to plus or minus 45^{0} versus 15^{0} previously; and 7) tri-level recording to give a dynamic range of 75 db.

FARRELL, P. J., 30-Day Ocean-Bottom Seismograph, Semiannual Tech. Rept. No. 2, Contract AF 19(628)-4075, Texas Instr., Inc., Dallas, Texas, 1965.

VESIAC 9620 VU

Texas Instruments was commissioned to drop and recover Thirty day OBS to test component and system reliability and to perfect handling procedures. After testing in the waters off Southern California personnel were transferred to Adak, Alaska, where five instruments were implanted and a reference land station installed. Several charges were detonated while the instruments were recording and other instruments were dropped at locations along the route to Japan and the Kuriles. Data are now being analyzed in Dallas. Despite significant improvement in techniques to transfer data to film significant results are not yet available.

FARRELL, P. J., W. A. SCHNEIDER, 30-Day Ocean-Bottom Seismograph, Aleutian and Kurile Operations, Final Report No. AFCRL-65-765, Contract AF 19(628)-4075, Texas Instruments Inc., Dallas, Texas, 1965.

VESIAC 12,913 VU
AD 623 512

The 30-day ocean-bottom seismograph senses ground motion through 1 vertical and 2 horizontal velocity seismometers and pressure variations through a transducer capable of response to 1.0 cps. Data are recorded continuously on magnetic tape and the unit has a depth capability of 25,000 ft. During the summer and fall of 1964, several drops were made in the area south of the Aleutian chain and northeast of the Island of Hokkaido, Japan. Power density spectra of ambient noise samples over a long time interval were selected from the two areas. Plots of these data versus time are presented and compared with simultaneous meteorological maps covering the respective areas. Results show a direct relation between ambient noise levels and local meteorological changes.

FARRELL, W., Gyroscopic Seismometer, Contract AF 49(638)-1388, University of California, La Jolla, California, 1967.

VESIAC 16,733 C VU

The modifications to the Pendulous Electric Vacuum Gyro (PEVG) Seismometer, described in the General Motors Defense Research Laboratory Report No. TR 66-23, Final Report on a D. C. Shift Seismometer, are briefly described.

FEDYNSKII, V. V., "Deep Seismic Sounding in the Complex of Regional Geophysical Investigations," USSR Ministry of Geol. & Mineral Conservation, Address Unknown, Undated, Received 1966, (Translated from Russian), Contract DA 49-083 OSA-3137.

VESIAC 14,463 VU

The author is concerned with making suggestions on how to direct the work in deep seismic sounding in the next few years in the USSR in such a way that it will have the greatest effect in solving a number of problems connected with the structure and development of the earth's crust. First, he gives a description of deep seismic sounding. Then he discusses the various directions in which research must be conducted in deep seismic sounding. Also discussed are economic considerations related to deep seismic sounding, and plans for deep seismic sounding during the next few years.

FEETHAM, W., and A. M. RUGG, TFSO Installation of Horizontal Array and Recording Building Modifications, Special Rept. No. 9, Order No. 6, Project VT/070, Contract AF 33(657)-7747, United ElectroDynamics, Inc., 1964.

VESIAC 10,318 VU
AD 454 256

Twenty-four horizontal short-period Johnson-Matheson seismometers have been installed in the crossed linear array at the TFSO as directed under the Work Statement. Recording instrumentation was added and modified to take care of the added seismometers. Some of the instruments were fabricated in UED's Pasadena plant. All of the installation was done by TFSO personnel. After the system was completely installed, it was calibrated and checked for proper phase. Operating parameters for the horizontal array are given; array installation and vault installation are described. Seismometer

Installation is discussed and the laying of cables. Recording building modification and installation are presented.

FENNER, P. R., Iterative Techniques for the Solution of Frequency-Domain Filter Sets, Special Sci. Rept. No. 16, Large-Array Signal and Noise Analysis, Contract VT/6707, AF 33(657)-16678, Texas Inst., Inc., Dallas, Texas, 1968

VESIAC 18,526 VU
AD 835 359

Computation of high-resolution wavenumber spectra includes the solution of a set of Hermitian equations. This report investigates three techniques of solving for the unknown vector a: the method of conjugate gradients, steepest-descent method, and exact-inverse method. The object is to determine the accuracy and computational complexity of each technique.

FENNER, P. R., Large-Array Signal and Noise Analysis - Special Sci. Rept. No. 15, Traveltime Analysis for LASA, Contract VT/6707, AF 33(657)-16678, Texas Inst., Inc., Dallas, Texas, 1967.

VESIAC 17,990 VU

This report investigates practical aspects of generating high-resolution wavenumber spectra using subarray outputs of the Montana LASA. Especially studied are the variability of traveltime anomalies as a function of wavenumber, spectral window effect on crosspower estimates due to moveout across the array, and tradeoffs involved in a finite-length transform of array data.

FENNER, P. R., Traveltime Analysis for LASA - Large-Array Signal and Noise Analysis, Special Sci. Rept. No. 15, Project VT/6707, Contract AF 33(657)-16678, Texas Inst., Inc., Dallas, Texas, 1967.

VESIAC 17,437 VU
AD 827 078

This report investigates practical aspects of generating high-resolution wavenumber spectra using subarray outputs of the Montana LASA. Especially studied are the variability of traveltime anomalies as a function of wavenumber, spectral window effect on crosspower extimates due to moveout across the array, and tradeoffs involved in a finite-length transform of array data. From this investigation, it is concluded that current data are insufficient to define a scheme adequately to correct wavenumber spectra calculations for traveltime anomalies. Also, because subarrays on the E and F rings of LASA generally exhibit larger traveltime residuals and less waveform similarity than do subarrays of the inner rings, subarrays on the E and F rings will not be included in high-resolution f-$\vec{k}$ spectra calculations.

FERNANDEZ, L. M., The Determination of Crustal Thickness from the Spectrum of P Waves, Rept. No. AFCRL-65-766, Contract AF 19(604)-7399, St. Louis University, St. Louis, Missouri, 1965.

VESIAC 13,039 VU
AD 624 844

To obtain information on the structure of the crust independent of the time, history, and spatial distribution of the source of energy, the spectrum of the vertical component of motion is divided by the spectrum of the horizontal component. This ratio represents the tangent of the apparent angle of emergence as a function of frequency.

It depends only on the angle of incidence of the ray and the system of layers below the recording station. The parameters of the crust may be determined by comparison of theoretical and observed spectra of this ratio.

To facilitate this comparison, a set of master curves was calculated using the matrix development of Haskell.

VESIAC 15,325 VU

FERNANDEZ, L. M., Final Report, Grant AF-AFOSR-1177-66, Contract AF-AFOSR-1177-66, San Calixto Observ., La Paz, Bolivia, 1966.

Five topics are discussed: (1) installation of the Peneas Acoustic Array: the low level of seismic noise present in the long-period instruments of the Peneas Seismic Array recommended installation in Bolivia of an acoustic array of microbarographs able to register infrasonic pressure disturbances of the atmosphere. Results of preliminary studies of terrain and meteorological conditions are given. Training of personnel, calibration of microbarographs, airlifting of equipment to La Paz, and installation and testing of equipment are mentioned; (2) the official dedication of the installation is described; (3) spectral analysis of acoustic records is considered; (4) detection of acoustic signals is described; and (5) an automatic correlator is described.

VESIAC 7124 VU
AD 431 020

FERNANDEZ, L. M., Variations in Amplitude of Short-Period P Waves, Tech. Rept. No. 63-106, Contract No. AF 49(638)-1150, Geotechnical Corp., Garland, Texas, 1963.

The variations of amplitudes of P waves generated by 12 teleseisms and detected by standardized short-period vertical instruments are investigated. The results are related to the local and regional geology of the site. Stations located on sandstone have an average amplitude almost two times the average amplitude of stations located on intrusive igneous and metamorphic rock. Stations located on limestone have amplitudes 1.2 times higher than stations on igneous intrusive and metamorphic rock. Variation of amplitude by a factor of 2 for stations located close together is not unusual although 85% of the stations have variations less than a factor of 4.

VESIAC 20,286 VU
AD 709 767

FILSON, J. R., On Estimating Explosive Source Parameters at Teleseismic Distances, Tech. Note, Rept. No. TN 1970-9, ESD-TR-70-196, Contract AF 19(628)-5167, Lincoln Labs., M. I. T., Lexington, Mass., 1970

A study has been made of the short-period spectra of five presumed explosions recorded at five arrays. An attempt has been made to relate contrasts in spectra of different events, recorded at the same site, to source size; and contrasts observed at different arrays for a given event, to the earth's attenuative properties. Haskell's model for the explosion spectrum was fitted to each event individually after corrections for instrument response and various exponential attenuations. At a single array, that attenuation which allowed the fitted parameters to vary as dictated by the model was chosen as the correct one. With the attenuation estimated to each array, the spectra observed at all the arrays for a single event are fitted to a source model simultaneously. In most cases the individual and simultaneous fitting schemes yield reasonable values for the source parameters. Haskell's model and the estimated attenuation parameter for a central Asia to LASA path apparently explains a trend in short period spectral ratio measurements as a function of magnitude.

FINK, D. R., R. S. DAHLBERG, Study of LASA Data Links, Rept. No. ESD-TR-67-221, Contract AF 19(628)-6141, Philco-Ford Corp., Blue Bell, Pa., 1967.

VESIAC 16,376 VU
AD 653 223

Investigation has been directed toward the utilization of data links for dissemination of seismic information from the Montana LASA to the scientific community. Methods and equipments are readily available for providing an essentially on-line seismic data link between LASA and potential data users. Analog and/or digital data transmission appears feasible, and relative requirements and costs per data channel have been detailed. As a result of the study, it is recommended that a teletype station bulletin be made available to those desiring it. It is also recommended that consideration be given to providing a data transmission facility at the Montana LASA Data Center so that data can be transmitted directly to interested users.

FISHER, R. L., A Study of Magnitude Determinations from Worldwide Data, VESIAC Rept. No. 4410-71-X, Contr. No. SD-78, Univ. of Mich., Inst. of Sci. & Tech., Ann Arbor, Mich., 1964.

VESIAC 8128 F VU
AD 441 592

One of the objectives of Texas Instruments' contract for Worldwide Collection and Evaluation of Earthquake Data is the study of the recent seismicity of the earth, based on smaller-magnitude shocks. Magnitude data for most areas are quite incomplete except above M = 6.0, and, consequently, calculation of lower magnitudes was a necessity. It was found in collecting data from a total of 150 stations, that the instrumentation varied widely in type and quality. Also, it was decided that all magnitudes would be reduced to Richter's scale.

FISHER, R. L., Worldwide Collection and Interpretation of Earthquake Data (Special Rept. No. 1), Reevaluation of Seismicity for 1960 and 1963, C-104-65, Texas Instr., Inc., Dallas, Texas, 1965.

VESIAC 12,624 VU

In this report are data having to do with annual earthquake recurrence, perhaps the most important contribution of seismicity studies to VELA UNIFORM. The 1960 and 1963 seismicity data have been extensively reviewed. In this review: (a) previously published data are revised and corrected; (b) data are prepared for comparison with 1964 seismicity as well as combination with the 1964 data to allow further statistical analyses to be performed; and (c) interpretations of the 1960 and 1963 data are modified, revised, and supplemented.

FISHER, R. L., Worldwide Collection and Evaluation of Earthquake Data, Terminal Report, Contract No. C-104-65, Texas Inst., Inc., Dallas, Texas, 1967.

VESIAC 17,294 VU
AD 665 015

This report discusses work performed from 28 April through 15 October 1966. During that period, the hypocenter and magnitude programs were tested and then used to process January 1964 data. Analysis of magnitude residuals indicate that patterns of residuals exist and might be used to infer source mechanisms.

The ratio of maximum P to P_n amplitudes is a function of distance, with maxima generally between 300 to 750 km. Considerable variation from station to station leads to the conclusion that m_b is currently unreliable when based on data recorded less than 1000 km from the source.

FISHER, R. L., R. G. BAKER and R. R. GUIDROZ, Worldwide Collection and Evaluation of Earthquake Data, Final Report on Evaluation of 1960 Seismicity, Contract AF 19(604)-8517, Texas Inst., Inc., Dallas, Texas, 1964.

VESIAC 7476 VU
AD 605 272

This is a study of the geographical distribution of world-wide level of seismic activity for 1960. The information can be used to delineate areas in which earthquakes of comparable size to nuclear explosions occur, and also to provide estimates of the annual numbers of these events. Five objectives of the study are presented, as well as a description of several presentation methods used to provide a comprehensive view of seismic activity. Data from 61 seismograph stations were processed and more than 4000 events of magnitude 3.0 and greater were investigated. Included is the information gathered from these investigations. One main conclusion: 1960 was highly seismic as compared to the average year pictured by Gutenberg and Richter.

FISHER, R. L. and R. GUIDROZ, World Wide Collection and Evaluation of Earthquake Data Evaluation of 1963 Seismicity, Final Rept., Contract AF 19(604)-8517, Texas Instr., Inc., Dallas, Texas, 1964.

VESIAC 9387 VU
AD 454 572

Seismic activity in 1963 is documented and compared to 1960 and other years. Other studies undertaken over the past three years are reviewed and summarized. The worldwide level of seismicity in 1963 is shown to have been considerably lower than in 1960. Comparison with Gutenberg and Richter's (1954) data shows 1963 seismic activity about average with respect to total shocks M_S greater than or equal to 6.0. However, more shocks in the range 5.0 greater than or equal to M_S less than 6.0 were recorded in 1963 than predicted by Gutenberg and Richter (1954). Epicenter maps are included; a seismicity map is included. Some 4800 events are listed. Computed and published magnitude data are included in the lists.

FIX, J. E., Development of LP Wave Discrimination Capability Using LP Strain Instruments, Quarterly Rept. No. 2, 1 October to 31 Dec. 1968, Rept. No. TR 69-6, Contract VT/8706, F33657-69C-0121, Teledyne Indust., Inc., Geotech Div., Garland, Texas, 1969

VESIAC 19,310 VU

The development of a design for a strain-inertial seismograph complex is progressing according to schedule. Signals will be detected in four passbands (periods are the 40 dB down points): long-period (5 to 250 sec), ultra-long-period (25 to 3000 sec), short period (0.05 to 4 sec), and broadband (permanent displacement to 1 sec). In the long-period passband, the moving coil system will have a sensitivity lower than the microseismic activity in a New Mexico mine and will not clip with an M_S = 6.0 earthquake at 30 deg. The ultra-long-period and broadband responses will utilize the stability of strain seismographs to obtain data for studying diagnostic information at longer periods. The laboratory model of the moving coil technique is being built. Noise spectra tests on the seismic amplifier suggest that more wire in the coil will improve the signal-to-noise ratio. The direct-current-variable capacitance technique design tests confirm the feasibility of the method; a laboratory model is being designed and built. Invar tubing will be used for the strain rod with a three point taut wire suspension. A mine near Phoenix, Arizona, has been selected, recommended to the Project Office, and approved by the Project Officer.

FIX, J. E., Development of LP Wave Discrimination Capability Using LP Strain Instruments, Quarterly Rept. No. 5, 1 July to 30 September 1969, Rept. No. TR 69-50, Contract VT/8706, F33657-69C-0121, Teledyne-Geotech, Garland, Texas, 1969

VESIAC 19,915 VU
AD 861 245

The final engineering model design of the strain/inertial complex is almost complete. About 90 percent of the fabricated, purchased, and government furnished equipment is on hand. Installation of the instrumentation has begun in parallel with the mine completion. The two recording vans are on site. Power is installed. Telephone service is expected soon. Some short-period inertial seismograms have been recorded at magnifications in excess of 500K. Until blasting is complete on the second horizontal tunnel and until excavation has reached sufficient depth on the winze, potential damage to the ventilation tubing will limit sustained effort to install the first horizontal strain seismometer. With inadequate ventilation, personnel experience severe headaches. Plans are being prepared for instrument tests and evaluations to be conducted as the instrumentation becomes operational.

FIX, J. E., Development of LP Wave Discrimination Capability Using LP Strain Instruments, Quarterly Rept. No. 7, 1 Jan. to 31 March 1970, Rept. No. 70-17, Contract VT/8706, F33657-69C-0121, Teledyne-Geotech, Garland, Texas, 1970

VESIAC 20,217 VU
AD 869 214

The mine preparation was completed by 2 February. Because of repeated delays, the mine modification subcontract was terminated before the full 40 m depth was reached. The vertical strain seismometer will be mounted in a 39-1/2 ft hole - 16 ft up and 23-1/2 ft down. The mine has been inspected and approved by the Office of the State Mine Inspector. Preliminary recordings have led to several conclusions. The mine must be sealed to attenuate effects of air pressure fluctuations. The strain seismometers must be insulated to achieve optimum performance. A "curing time" of some duration is necessary for extreme high-magnification operation. Spurious disturbances resulting from disturbance of the mine during mine modifications and installation are decreasing with time. The noise background on the preliminary recordings is not electronic instrument noise. The strain seismographs respond well to earthquake signals.

FIX, J. E. and J. R. SHERWIN, Development of LP Wave Discrimination Capability Using LP Strain Instruments, Quarterly Rept. No. 4, 1 April to 30 June 1969, Rept. No. TR 69-45, Contract VT/8706, F33657-69C-0121, Teledyne-Geotech Co., Garland, Texas, 1969

VESIAC 19,828 VU
AD 859 128

The development of a design for a three-component strain/inertial complex is almost complete. The moving coil-permanent magnet technique has been selected for the primary transducer. Noise tests on the preamplifier demonstrated that using more turns of wire in the coil will give a 1.8 signal-to-noise improvement at periods longer than 20 sec without affecting the signal-to-noise ratio at shorter periods. Based on microseisms at Las Cruces, New Mexico, the ground motion signal will be larger than instrument noise at periods shorter than 90 sec and instrument noise will be larger at longer periods.

FIX, J. E. and J. T. SHERWIN, Development of LP Wave Discrimination Capability Using LP Strain Instruments, Quarterly Rept. No. 6, 1 October 1969 to 31 December 1969, Rept. No. TR 70-5, Contract VT/8706, F33657-69C-0121, Teledyne Indust., Inc., Geotech Div., Garland, Texas, 1970

VESIAC 20,083 VU
AD 865 282

The engineering model design of the strain/inertial complex is complete. The engineering model of the optical displacement transducer has been built and tests indicate that the design goals can be met. The short-term noise level is 3×10^{-9}m rms. Progress in preparation of the mine has been slow. The 55 deg azimuth horizontal tunnel is complete. The 325 deg azimuth tunnel is complete except for mounting holes for the instruments. The winze has been excavated down 26 $\pm$ 2 ft. The fabrication of all equipment is complete except two displacement transducers. The second and third magnets have been received with stabilized flux of 1.187T and 1.180T. This flux and the coils on hand will give transducer generator constants of 33,600 V/m/sec and 37,300 V/m/sec. Installation is progressing in parallel with completion of the mine. The following seismographs have been installed and test recordings have been made at the corresponding magnifications given for X10 view of 16-mm film: short-period inertial - 500K at 1 sec; long-period inertial - 100K at 25 sec with 6 sec notch, 20K without notch; 55 deg azimuth horizontal strain - 1.4 mm/10^{-11} strain. The strain magnification will be increased after the mine is sealed and the seismometer is insulated. Numerous strain relief pulses were recorded several hours before a 4 kg rock fell from the mine wall. Single and dual pulses of strain have been recorded for local events (S-P time 11 to 13 sec) shortly after the P arrival and before the S arrival. Multiple strain pulses have been recorded in the latter part of a teleseismic surface wave train.

FIX, J. E., and J. R. SHERWIN, Development of LP Wave Discrimination Capability Using LP Strain Instruments, Quarterly Rept. No. 8, 1 April to 30 June 1970, Rept. No. TR 70-29, Contract VT/8706, F33657-69C-0121, Teledyne-Geotech, Garland, Texas, 1970

VESIAC 20,392 VU
AD 875 027

Progress during the second quarter of 1970 is reported. Magnets and coils on the LP inertial seismometers were returned to a standard configuration to match the strain response. A low-pass filter on the input to the strain preamplifier has limited amplifier saturation from large signals out of the passband. The mine seal has been improved to a 4 hour time constant. Three methods of obtaining system transfer functions from special test data were investigated.

FIX, J. E., and J. R. SHERWIN, Development of LP Wave Discrimination Capability Using LP Strain Instruments, Quarterly Rept. No. 9, 1 July 1970 through 30 Sept. 1970, Rept. No. 70-31, Contract VT/8706, F 33657-69C-0121, Teledyne Indust., Inc., Geotech Division, Garland, Texas, 1970

VESIAC 20,459 VU

Progress during the third quarter of 1970 is reported. The side-by-side tests have been completed and the second 325 deg azimuth horizontal strain seismometer (S325) has been installed as the SZ vertical seismometer. Earth tides are being recorded on all three components. Amplitude response of the strain seismographs has been measured.

FIX, J. E. and W. TUCKER, Rapid Spectral Analysis with a Convolver, Tech. Rept., Contract AF-AFOSR 414-67, Southern Methodist Univ., Dallas, Texas, 1967

VESIAC 18,533 VU

A technique has been developed for rapid spectral analysis on a small general purpose digital computer. This technique uses a standard convolver unit available as optional equipment for accomplishing the many multiplications and additions necessary in calculating the autocorrelation function of 8190 data points with up to 512 lags or the crosscorrelation function of 4094 data points with up to 512 lags.

FLECK, P. L., FASTABUL (A Fast Automatic Station Bulletin (Program), Tech. Note 1967-3, Rept. No. ESD-TR-67-16, Contract AF 19(628)-5167, Lincoln Lab., Mass. Inst. of Tech., Lexington, Mass., 1967.

VESIAC 15,323 VU
AD 646 207

A real-time program for a digital computer is described which uses the sampled outputs of an array of 21 seismometers as input. These data are reduced and output as a typewritten list of the physical parameters of any "event" present in the original data. The physical parameters automatically listed are some of the standard items included in the international seismic bulletin (epicenter location, origin time and magnitude). Results of this automatic method are presented.

FLECK, P. L., A Seismic Data Analysis Console, Tech. Note, Rept. Nos. TR 68-191, TN 68-14, Contract AF 19(628)-5167, Lincoln Labs., M. I. T., Lexington, Mass., 1968

VESIAC 18,507 VU
AD 671 961

A software system for a PDP-7 digital computer with a cathode ray tube display has been designed to process seismic data. The system permits quick visual inspection of digitized data and allows easy application of powerful programs which operate on the digitized data or on the results of previously used programs. Some operations which can be performed are: epicenter location, beamforming, magnitude, complexity and spectral ratio computation, filtering autocorrelation, Fourier transformation, sonogram generation and automatic event detection.

FLETCHER, N. H., J. B. WELLEN, G. S. GERLAND, and J. L. LOBDELL, Automated Bulletin Process, Preliminary Report, Rept. No. 119, Project VT/2037, AF 33(657)-12447, United ElectroDynamics, Inc., Pasadena, Calif., 1965.

VESIAC 10,320 VU
AD 460 632

A FORTRAN computer program has been written to associate seismic phase arrivals at a number of stations, with epicenters reported by U. S. Coast and Geodetic Survey, and to identify up to 23 phases. Criteria used to identify these phases are listed. The program was developed to automate phase identification for the monthly earthquake bulletins of the five VELA UNIFORM seismological observatories.

FLINN, E. A., Confidence Regions and Error Determinations for Seismic Event Location, Contr. No. VT/2037, AF 33(657)-12447, United ElectroDynamics, Inc., Pasadena, Calif., 1964.

VESIAC 7739 VU
AD 437 957

Discussed is a digital computer program written to locate seismic events and to determine the standard errors and point confidence regions for the focal coordinates. Results of analyses of 13 nuclear explosions in Nevada show a mean computed depth of focus of 39 plus or minus 2 kilometers. Included is a discussion of the displacement of the computed epicenter from the known epicenter. Also discussed are linearized point confidence regions for latitude and longitude which were computed for all events, and the exact confidence regions that can be constructed for the focal coordinates. The axis ratio and orientation of the confidence region for latitude and longitude depends only on station distribution in distance and azimuth around the epicenter.

FLINN, E. A., A Theoretical Discussion of Optimum Multichannel Filter Design, Sci. Rept., Rept. No. 227, Contract VT/6702, F33657-68C-0945, Teledyne Indust., Inc., Alexandria, Va., 1968

VESIAC 19,160 VU

The design equations for both single channel and multi-channel optimum least-squares ("Wiener") filters are derived and discussed. Specific examples of such filters are presented; for example, inverse filters, signal/noise ratio enhancement filters, prediction filters, and maximum-likelihood filters. The single-channel and multichannel Levinson recursion algorithms for solving the design equations are discussed.

FLINN, E. A. and W. C. DEAN, Tables of Zeros and Weight Factors for the Zero Order Laguerre Polynomials from the 3rd to the 100th Degree and their Application to Fourier-Laguerre Transforms, Contract No. AF 49(638)-1117, United ElectroDynamics, Inc., Pasadena, Calif., 1964.

VESIAC 8386 VU
AD 443 976

Section I of this report describes the numerical methods suitable for machine computation of both direct and inverse Fourier transforms from the Laguerre expansions. Section II presents tables of the zeros and the weight factors for the zero order Laguerre polynomials necessary for numerical expansion of transients in Laguerre series. The tables give the zeros and weight factors in double precision for all Laguerre polynomials of degree 3 to degree 100.

FLINN, E. A., R. A. HARTENBERGER, D. W. MC COWAN, The Crosswise Sum Method for Maximum-Likelihood Filtering of LASA Seismograms, Scientific Report No. 150, Contract VT/6702, AF 33(657)-15919, Teledyne Industries, UED Division, Alexandria, Va., 1966.

VESIAC 14,641 VU
AD 485 031 L

Two earthquakes, (10 November 1965 and 25 November 1965), were processed and analyzed using the "crosswise sums" method. First, 25 traces are formed each the phased sum of 21 prefiltered subarray traces, (one from each subarray) and then the set is maximum-likelihood filtered. The final outputs from the maximum-likelihood filter are 1.5 to 4 db down in S/N from the phased sum of all of LASA. The signals are remarkably similar on these 25 crosswise sum traces; so much that the symmetrical maximum-likelihood filter introduced no precursor.

FLINN, E. A., R. A. HARTENBERGER, and D. W. McCOWAN, An Example of Maximum-Likelihood Filtering of LASA Seismograms, Contract VT/6702, AF 33(657)-15919, Teledyne Industr., Inc., Earth Sci. Div., Alexandria, Va., 1966.

VESIAC 16,656 VU
AD 629 739

Realizable maximum-likelihood filtering was compared to time-shift-and-summation (phased summation) as an array processing procedure, using records from a single earthquake made by 398 seismometers at the Montana Large Aperture Seismic Array (LASA). The records were prefiltered to eliminate long-period microseismic noise. Within a single subarray (seven kilometers diameter), the maximum-likelihood filter improved signal-to-noise ratio approximately 5 db more than the phased sum. As a method for combining subarray outputs there was no significant difference between the maximum-likelihood filter and phased summation. Approximately two hours of CDC 1604-B machine time were required to calculate the maximum-likelihood filter for each 19-channel subarray.

FLINN, E. A., R. A. HARTENBERGER, and D. W. MC COWAN, Maximum-Likelihood Filtering of LASA Noise Seismograms, Scientific Report No. 149, Contract VT/6702, AF 33(657)-15919, Teledyne Industries, UED Division, Alexandria, Va., 1966.

VESIAC 14,640 VU
AD 485 030 L

Realizable and symmetrical maximum-likelihood filters, two sec long and based on fitting intervals consisting of 75, 150, 180, and 300 sec of both raw and bandpass filtered inputs, were computed using seismic noise recorded during the night of 25 March 1966, by 19 sensors in the AO subarray at the Montana LASA

Depending upon the nature of the input data (raw or prefiltered), the symmetrical filter is 1 to 5 db better than the corresponding realizable filter, but its output appears to be approximately 180 deg out-of-phase with its realizable counterpart.

FLINN, E. A., R. A. HARTENBERGER, and D. W. MC COWAN, Two Examples of Maximum-Likelihood Filtering of LASA Seismograms, Sci. Report No. 148, Contract VT/6702, AF 33(657)-15919, Teledyne Indus., UED Division, Alexandria, Va., 1966.

VESIAC 14,639 VU
AD 485 029 L

Realizable and symmetrical maximum-likelihood filtering was compared to timeshift-and-summation (phased summation) as array processing procedures, using records from two earthquakes made by seismometers at the Montana LASA. The records were prefiltered to eliminate L-P noise. Within a single subarray, the maximum-likelihood filter improved the S/N approximately 2 db more than the phased sum, if the noise was measured outside the fitting interval. As a method for combining subarray outputs there was no significant difference between the maximum-likelihood filters and phased summation. Complexity factors over subarrays and over LASA were computed for one event and compared with those computed from three additional events and three shots.

FLORES-CALDERON, J. L., Average Travel Time for the Iberian Region, Sci. Rept. No. 25, Contract AF 61(052)-657, Instituto Geografico Y Catastral, Madrid, Spain, 1968.

VESIAC 18,329 VU

Using travel time and epicentral distances for 84 earthquakes (1961-66) recorded at Spanish stations, a linear adjustment has been made by least square method, attaining velocities as follows: Pn = 7.83, Pb = 6.49 and Pg = 5.56, through the Iberian Peninsula region.

FORBES, C. B., R. OBENCHAIN, and R. MC LAMORE, The LASA Signal Acquisition System, Contract: VT/5071, AF 33(657)-14104, Teledyne, Inc., UED, Alexandria, Va., 1965.

VESIAC 13,858-A VU
AD 648 415

This discussion of the LASA Signal Acquisition System emphasizes the appearance and operational characteristics of the system, with only casual reference to the process of installing the system. It is shown that advantage was taken of all opportunities to minimize maintenance requirements on the signal acquisition system while permitting ease of access for experimentation and adjustment.

FRANCIS, G. F., Tonto Forest Seismological Observatory, Spec. Rept. No. 5, Contract VT/070, AF 33(657)-7747, United ElectroDynamics, Inc., Pasadena, Calif., 1962.

VESIAC 9569 VU
AD 609 538

The report describes progress through July 31 on the installation of a 21-element crossed linear array, one line of which is pointed in the direction of the Nevada Test Site. At the time of the report, a description of instrumentation, calibration and damping, and most of the installation procedures was possible since this work was nearly completed. All that remained to be done were the final preparations, such as the installation of tape recorders and completion of calibration and covering. A chart of grid coordinates is provided, but no further information about the aims of the project.

FRANCIS, G. F., and A. M. RUGG, TFSO Evaluation Tests, J-M Seismometer Special Report No. 12, Project VT/070, Contract AF 33(657)-7747, United ElectroDynamics, Inc., Pasadena, Calif., 1964.

VESIAC 10,284 VU
AD 454 257

Tests described in this report, using the shake table at TFSO, concern procedures for determining the calibration coil meter constant, G, and for computing magnification of seismographs by the sine wave calibration method. These procedures are applicable to the calibration of the Johnson-Matheson (J-M) seismograph and are followed at TFSO. Eight studies, which form part of the experiment, are discussed, in reference to a preliminary study which was made to determine the calibration constant, applicable to weight-lift calibration, and a more thorough study, in which measurements were made at nine values of seismometer damping using three galvanometers having natural frequencies of 1.4, 3, and 5 cps.

FRANK, F. C., Introduction to the Discussion on Source Mechanisms, Rept. No. 7885-1-X, Contract DA 49-083 OSA-3137, SD-78, Univ. of Mich., Inst. of Sci. & Tech., Ann Arbor, Mich., 1967.

VESIAC 15,915-S VU

A review of work which has been done on faulting mechanics is presented.

FRANKOWSKI, D. E., LASA Data Service Report, Quarterly Rept. No. 7, 1 October 1968 to 31 December 1968, Contract F44620-67C-0075, Teledyne Indust., Inc., Alexandria, Va., 1968

VESIAC 19,402 VU

This is the seventh quarterly report issued by the LASA Data Service and covers the work performed from 1 October 1968 through 31 December 1968.

The LASA Data Service (LDS) was established in March 1967, to make LASA data available to all interested users. The LDS has been expanded to include the Norwegian Seismic Array (NORSAR) and to serve as a repository of digital infrasonic data collected from a worldwide network of stations.

FRANKOWSKI, D. E., LASA Data Service Rept., Final Rept., 1 April 1968 to 31 March 1969, Contract F44620-67C-0075, Teledyne Indust., Inc., Alexandria, Va., 1969

VESIAC 19,675 VU

This report summarizes the data services which the LASA Data Services contract can perform for interested users, plus a summary of the data services which were performed for individual users during the applicable period.

FRANKOWSKI, D. E., F. A. KLAPPENBERGER, Travel-Time Anomalies at LASA, Contract AF 19(628)-5167, Teledyne Indust., Inc., Earth Sci. Div., Alexandria, Va., 1967.

VESIAC 16,668 VU

World-wide average travel-time curves are inadequate to permit optimum phasing of teleseismic signals. Phase alignment corrections in the form of station relative travel-time anomalies of LASA, based on approximately 570 events, are presented.

FRANKOWSKI, D. E., A. L. KURTZ, R. D. MIERLEY, and P. A. SANTIAGO, Signal and Noise Responsiveness at LASA, Contract AF 19(628)-5167, Teledyne Industries, Inc., Earth Sci. Div., Alexandria, Va., 1967.

VESIAC 16,082 VU
AD 655 109

Signal and noise responsiveness at LASA are presented. Signal responsiveness is given as peak-to-peak measurements. Noise responsiveness is given as spectral estimates in various frequency bands.

FRANTTI, G. E., Investigation of Short-Period Seismic Noise in Major Physiographic Environments of Continental U. S., Rept. Nos. 4711-22-F 5178-47-T, Contract Nos. AF 19(628)-200, AF 49(638)-1170, Univ. of Mich., I. S. T., Ann Arbor, Mich., 1965.

VESIAC 10,585 VU
AD 617 122

Measurements of spectral density levels of short-period seismic noise are obtained for points distributed throughout the continental U. S. and for a few non-North American locations. Noise amplitudes and gradients in the far field correlate on a regional basis with major physiographic provinces, as revealed by iso-particle-velocity contouring. The ensemble of space and time samples of noise is examined to illustrate the average spectrum and dispersion for three orthogonal components of ground-particle velocity in the range 0.25 to 100 cps. Presented are probability distributions of noise amplitudes based on a collection of space averages. The ratio of horizontal to vertical noise amplitude (H/Z) is discussed.

FRANTTI, G. E. and L. A. LEVEREAULT, Investigation of Auditory Discrimination of Seismic Signals from Earthquakes and Explosions, Final Rept., Contr. No. AF 49(638)-1079, Univ. of Mich., Inst. of Sci. & Tech., Ann Arbor, Mich., 1964.

VESIAC 7721 VU
AD 437 784

Magnetic tape recordings of short-period seismic signals from approximately 200 earthquakes and explosions were time-compressed by a factor of up to 512 to shift frequencies to the audible range. These seismic data include the inhomogeneities introduced by substantial variations in the locations of sources and receivers (worldwide), propagation path length (32 to 7000 km), and source magnitude ($M = 0.5$ to $M = 6.5$). Subjects were trained with a representative set of the "seismic sounds." Auditory experiments were conducted to determine the ability of the human auditory system to distinguish between seismic signals from earthquakes and explosions. Results suggest that a trained listener can identify approximately two thirds of the seismic sounds.

FUCHS, K., "Crustal Structure of the Western Alps According to Seismic Refraction Measurements," Gerlands Beitr. Geophys., Vol. 72, No. 3, pp. 149-169, 1963, (Translated from German). Contract SD-78.

VESIAC 7135 VU

The interpretation of the seismic records which were obtained in the course of international experiments carried out in the western Alps between 1956 and 1960 led to the following results:

a) The top of the basement rock characterized by a velocity of 6.0 km/s is found at a relatively shallow depth everywhere;

b) At the edge of the Po plain, the Ivrea discontinuity sharply outlines the upper boundary of a dense body of basic rock which is responsible for an important positive gravity anomaly;

c) The isobaths of the Mohorovicic discontinuity could be delineated. They demonstrate that there is a root below the Alps. The vast zone where the Mohorovicic discontinuity reaches to greater depths coincides with the alpine Piedmont zone, i.e., with the "great alpine fosse."

FUENZALIDA, J., Attenuation of Seismic Waves in the Earth's Upper Mantle, Tech. Note, Contract AF 19(628)-5981, General Atronics Corp., Philadelphia, Pa., 1966.

VESIAC 17,628 VU
AD 823 044

A suggestion by Dr. Eugene Herrin that the large discrepancies in the measured spectra from LONGSHOT might result from low Q regions in the earth's upper mantle prompted a brief study to discover whether it is possible to determine the existence of such layers using the spectra of the P and pP phases of deep earthquakes. This technical note describes the results obtained to date.

GALAKTIONOV, A. B., "Density of Sedimentary Rocks of the Ustyurt," Prikladnaya Geof., No. 23, pp. 127-135, 1959, (Translated from Russian), Contract SD-78.

VESIAC 11,996 VU

In recent years a large number of gravimetric studies has been carried out in the Ustyurt Plateau and in the adjacent regions. However, the lack of data on the physical properties of rocks which make up the geological structure of this large territory complicates the quantitative interpretation of the geophysical material. This work is an attempt to fill this gap. It is based on materials obtained by the laboratory of physical properties of the VNIIGeofizika in connection with the study of rock specimens collected by the party of the institute from the western slope of the Ustyurt on the Kugusem-Karamainsk anticline.

GALANOPOULOS, A. G., Aftershock Sequences and Crustal Structure in the Region of Greece, Sci. Progress Rept. No. 8, Contract AF 61(052)-803, Natl. Observ. of Athens, Athens, Greece, 1967.

VESIAC 16,648 VU
AD 652 516

This report presents results of work accomplished in the first three years of the contract and describes the work now in progress. Included in the report are papers on (1) a study of the increase in earthquake activity in the Cremasta Lake region and (2) an investigation of the seismotectonic regime in Greece.

GALANOPOULOS, A. G., The Earthquake Activity in the Physiographic Provinces of the Eastern Mediterranean Sea, Sci. Interim Rept. No. 11, Contract AF 61(052)-803, Natl. Observ. of Athens, Athens, Greece, 1968

VESIAC 19,041 VU
AD 676 657

An individual feature of the Eastern Mediterranean is the steady association of shallow and intermediate foci in a narrow zone of about 3^{0} width. This and the unilateral distribution of epicentres indicate that the history of the Mediterranean Ridge is not similar to that of the Mid-Oceanic Ridge. There are reasons to believe that the median ridge might be a less developed zone of underthrusting. The rarefying of the epicentres along the ridge, the differing texture of the surface south of the crest and the abrupt cessation of the earthquake activity southwards of the ridge speak in favor of the notion.

GALANOPOULOS, A. G., "The Seismicity of the Island of Chios," Gerl. Beitr. Geophys., Vol. 63, No. 4, pp. 253-264, 1954, (Translated from German), Contract SD-78.

VESIAC 9192 VU

After a brief report of the geological structure of Chios Island and the Peninsula of Erythrae, a summary of the seismic effects of all damaging shocks on Chios Island known since 1389 is presented. A critical discussion follows concerning the distribution of the effects of the last disastrous earthquake of July 23, 1949 and of the foci of all major earthquakes. Finally, the presence of at least two foci near Chios Island is noted, one in the Chios Straits, near the SE coast of the island, and the other close to the NW coast of Oenoussae Island.

GALANOPOULOS, A. G., and N. D. DELIBASIS, The Seismic Activity in the Cyprus Area, Sci. Rept., Contract AF 61(052)-803, Natl. Observ. of Athens, Athens, Greece, 1965

VESIAC 19,046 VU
AD 662 451

This report contains information on the surface geology of Cyprus, the geological structure, history of earthquakes and a table of earthquake shocks in the area of Cyprus.

GALANOPOULOS, A. G., B. C. PAPAZACHOS, Aftershock Sequence and Crustal Structure in the Region of Greece, Annual Summ. Rept. No. 1, Contract AF 61(052)-803, Natl Observ. of Athens, Athens, Greece, 1965.

VESIAC 14,683 VU
AD 627 616

This report describes the progress made in studies concerning the crustal structure in southeastern Europe, aftershock sequences, and seismicity. Sites for four seismograph stations have been selected and most of the instrumentation has been purchased.

GALANOPOULOS, A. G., B. C. PAPAZACHOS, Aftershock Sequence and Crustal Structure in the Region of Greece, Annual Summ. Rept. No. 2, 1 June 1965 to 31 May 1966, Contract AF 61(052)-803, Natl Observ. of Athens, Athens, Greece, 1966.

VESIAC 14,958 VU
AD 652 516

This report gives a summary of the work performed and a description of the major accomplishments under terms of the contract, during the period June 1, 1965 to May 31, 1966. The studies summarized include: (1) Crustal Structure in Southeastern Europe. This work falls into two categories; a study of crustal structure by using travel times of P waves, and a study of crustal structure by using dispersed wave data; (2) Aftershock Sequences. The foreshock and aftershock sequences of all the major shallow earthquakes that occurred in the region of Greece from 1926 till 1964 have been investigated, and are discussed; (3) Installation of New Stations and Instruments; and (4) Research Planned.

GALANOPOULOS, A. G., and B. C. PAPAZACHOS, Aftershock Sequences and Crustal Structure in the Region of Greece, Final Sci. Rept., Contract AF 61(052)-803, Natl. Observ. of Athens, Athens, Greece, 1969

VESIAC 19,807 VU
AD 693 323

This paper summarizes the research work accomplished over a five year period of the contract with the Air Force. Six new stations were installed in appropriate sites in the region of Greece.

A study was made of the distribution in time and magnitude, the strain release characteristics and other properties of the aftershock and foreshock sequences 1) of all shocks of $M>5.9$ which have occurred in Greece between 1911 and 1968, and 2) of smaller main shocks which occurred between 1957 and 1967.

Some basic crustal and upper mantle properties in the region of Greece were determined by using travel times of body waves and dispersion properties of surface waves.

The relation between the water loading of two artificial lakes and the earthquake activity in foreshocks or swarm of shocks triggered by this anamolous change of fluid pressure was investigated. Seismicity and problems of Geotectonics in connection with results derived from the study of crustal structure and aftershock sequences was investigated.

The technical work performed, the research work accomplished and the research work in progress are all summarized.

GALAT, G., and R. SAX, Horizontal Array Response of Several Wave-number Analysis Methods, Sci. Rept., Rept. No. 244, Contract VT/970(F33657-69C-0913, Teledyne Indust., Inc., Alexandria, Va., 1969

VESIAC 20,260 VU
AD 870 768

In this report we evaluate the performance of a small array as regards detection and identification of signals in frequency-wavenumber space. A two dimensional array is phased to form a one-dimensional array oriented in the direction of simulated signals. Signal discrimination is tested by varying the amplitude, velocity, frequency content and back azimuth of these generated signals. Illustrations of f-k and k_x, and k_y spectra plots show that, using a small array, neither the standard nor the high resolution frequency-wavenumber analysis can successfully detect small P-waves in ambient P-wave noise. It is concluded that current f-k analysis techniques when used on data from small arrays can easily produce misleading results.

GALBRAITH, F. W., M. V. BARTON, VELA UNIFORM-PLOWSHARE Program, Project GNOME - Shock Spectrum Measurements, Rept. No. VUF-2401, Contract Project 1.7, Space Tech. Labs., Redondo Beach, Calif., 1965.

VESIAC 14,102 VU
AD 617 321

Displacement shot spectra from the GNOME underground nuclear explosion were measured by twelve reed gages. Seven gages, installed on the ground surface at four locations out to a distance of 3000 feet from surface zero, provided usable records. Four were installed in the floor of the GNOME tunnel at two locations. Those at 1033 feet gave valid records; those at 900 feet were not recovered after the test. A gage nine miles away did not record any motion. Plotted displacement spectra showed that displacements and peak accelerations decreased with increasing slant range for the surface gages. The vertical spectra were higher than the corresponding horizontal radial spectra for the surface gages. For the gages in the GNOME tunnel, the horizontal radial spectrum was higher than the vertical.

GALLAGHER, J. N., P. DEHLINGER, Oregon State University Seismological Bulletin No. 6, 1 Oct. to 31 Dec. 1964, Data Rept. No. 20, Contract AF 19(628)-2778, Oregon State Univ., Corvallis, Ore., 1965.

VESIAC 13,707 VU
AD 621 717

Oregon State Univ. operates a World-Wide Standard Seismograph Station at Corvallis (COR) and a seismic station at Klamath Falls (KFO), Oregon. The Portland (PTD), Oregon, seismic station is operated by the Oregon Museum of Science and Industry. This report includes seismic data recorded at the Corvallis, Klamath Falls, and Portland, Oregon, seismic stations from October 1 to December 31, 1964.

GAL'PERIN, E. I., "Azimuthal Deviations of Seismic Rays," Izv. Akad. Nauk, SSSR, Ser. Geofiz., No. 11, pp. 1282-1293, 1956, (Translated from Russian), Contract DA 49-083 OSA-3137.

VESIAC 15,019 VU

A method is proposed for representing azimuthal deviations in the form of a field of azimuthal deviations. The general regularities of fields of azimuthal deviations are analyzed for waves related to a plane interface. Examples of fields of azimuthal deviations of reflected waves are presented with consideration of intermediate refraction.

GAL'PERIN, E.I. and I. P. KOSMINSKAYA, Structure of the Earth's Crust in the Transition Region from the Asiatic Continent to the Pacific Ocean, Academy of Sciences U. S. S. R., The O. Yu. Schmidt Institute of Earth Physics Pub., Moscow, Russia, 1964, (Translated from Russian), Contract SD-78.

VESIAC 13,067 VU

Results are described of the interpretation of data by deep seismic sounding of the earth's crust in the Okhotsk Sea, the Kurile-Kamchatka zone of the Pacific Ocean, in the Komandorskian regions of the Bering Sea and the Pacific Ocean, and on the section Magadan-Kolyma.

Seismic profiles and maps are cited for the various structural stages of the earth's crust: the sedimentary layer, the surface of the consolidated crust and the Mokhorovichich boundary. Data for the plan of zoning according to types of crust and structures of higher orders are given.

GAMBURTSEV, G. A., "Determination of the Azimuth of the Epicenter During the Registration of Local Earthquakes," Doklady Akad. Nauk SSSR, Vol. 37, No. 2, pp. 205-206, 1952, (Translated from Russian), Contract SD-78.

VESIAC 13,415 VU

In the registration of local earthquakes at stations of the regional type located in mountainous seismically active regions, serious difficulties are often encountered in determining the direction to the epicenter. But although the difficulties of determining azimuths in mountainous regions is manifest, it is also true that there are ways of overcoming these difficulties. First, it is advisable to introduce correlation principles in the registration of local earthquakes, e.g., positional and azimuthal correlation. In addition, a number of other measures such as locating the station in the simplest possible geologic foundations should be adopted.

GAMBURTSEV, G. A., "A New Type of Phase Correlation in Seismic Observations," Doklady Akad. Nauk SSSR, Vol. 87, No. 1, pp. 37-40, 1952, (Translated from Russian), Contract SD-78.

VESIAC 13,416 VU

Seismic surveying correlation refers to the operation of tracing waves (wave correlation) or wave phases (phase correlation) as a function of the position of the points of observation. After discussing the general value of correlation methods, he passes to a discussion of "azimuthal" correlation, which is described fully.

Besides azimuthal correlation, one can carry out a correlation as a function of the angle of inclination of the axis of the seismograph, or as a function of the direction of arrival of seismic waves. One can also carry out certain combined methods of correlation — for example, simultaneous execution of positional and azimuthal correlations. Special features of azimuthal correlation are pointed out.

GAMBURTSEV, G. A., "Optical Seismic Tiltmeters," Izv., Akad. Nauk, SSSR, Ser. Geofiz., No. 4, pp. 305-311, 1954, (Translated from Russian). Contract DA 49-083 OSA-3137.

VESIAC 15,142 VU

A statement is made of the theory of a new type of instrument — the optical seismic tiltmeter. This instrument is intended for the recording of slow vibrations of the earth's crust in a prescribed range of frequencies, and especially for the recording of L-P seismic waves. The possibility is pointed out of obtaining very high sensitivity by means of "double" seismic tiltmeters.

GAMBURTSEV, G. A., "The Regions of the Kinematic Possibility of the Existence of Refracted Waves in the Presence of an Inversion of Layer Velocities," Izv. Akad. Nauk, SSSR, Ser. Geofiz., No. 6, pp. 1-4, 1951, (Translated from Russian), Contract DA 49-083 OSA-3137.

VESIAC 15,143 VU

A comparison is made of the regions of the kinematic possibility of the existence of refracted (head) waves for a two-layered medium and a three-layered medium with an intermediate inversion layer. It is shown that the inversion layer can cause a substantial shift of the boundaries of these regions, which in turn can involve the removal of, or on the other hand, the formation of shadows over the underlying boundaries.

GANGI, A. F., Research in Theoretical and Model Seismology, Final Sci. Rept., 16 December 1966 to 16 November 1967, Rept. No. AFCRL 67-0600, Contract F19628-67C-0126, Mass. Inst. of Tech., Cambridge, Mass., 1967

VESIAC 18,660 VU

Various aspects of model seismology were investigated including: 1) laminated two-dimensional model fabrication and property measurement; 2) the use of variable repetition rates to eliminate reverberations in finite size models; and 3) the measurement of seismic model transducer properties and the comparison with theoretical calculations. A computer algorithm for the accurate and automatic determination of seismic array steering delays is presented.

GARLAND, G., K. VOZOFF, and G. L. CUMMING, Investigation of the Crust In Western Canada by Seismic Refraction and Magnetotelluric Methods, Semiannual Tech. Rept., Contract No. AF 19(604)-8470, Univ. of Alberta, Alberta, Canada, 1962.

VESIAC 5560 VU

The University of Alberta intends to use a series of large chemical explosions in southern Alberta for the construction of travel time curves, to provide information on the dip of discontinuities, to measure the electrical conductivity of the crustal layers and to trace the Conrad and Mohorovicic discontinuities westward from the test site at lat. 50 degrees, 30 minutes N., long. 111 degrees, 40 minutes W. No data are included in this statement of the contract problem.

GARLAND, G., K. VOZOFF and G. CUMMING, Investigation of the Crust in Western Canada by Seismic Refraction and Magnetotelluric Methods, Semiannual Tech. Rept., Contract No. AF 19(604)-8470, Univ. of Alberta, Alberta, Canada, 1963.

VESIAC 5561 VU

No explosions had taken place at the time of this report. Two Texas Instruments 2-cycle vertical component seismometers, amplifiers and cameras were tested, and 3 Willmore seismometers adapted for use with the recording system. Timing of the arrivals is to be by VHF broadcast of a zero-time indication from the shot site. A map indicating the location of 10 shot holes is included.

GARRETT, C. L. and J. D. KERR, Stable Table, Contract No. VT/072, AF 33(657)-9967, Geotechnical Corp., Garland, Texas, 1964.

VESIAC 8478 VU
AD 446 572

A single-degree-of-freedom stable table has been developed and an engineering model has been evaluated. The table is designed to isolate seismometers and other equipment from earth motion. The platform is stabilized against vertical earth and live-load disturbances by electromechanical servofeedback loops. Isolation is provided over the band of 0.01 cps to 50 cps. A maximum isolation of 42 db at midband (0.5 cps) is obtained. Preliminary design concepts for a six-degree-of-freedom stable table have been established. It will be stabilized against translations along the X-, Y-, and Z-axis and against rotation about these axes. Since this platform will be stabilized against all disturbances, much equipment can be tested under optimum conditions.

GASKELL, T. F., High Frequency Energy from Earthquakes, VESIAC Special Rept. No. 4410-52-X, Contr. No. SD-78, Univ. of Mich., Inst. of Sci. & Tech., Ann Arbor, Mich., 1964.

VESIAC 7742 C VU
AD 438 709

During the period from February to October of 1962, the USGS made seismic recordings of nuclear explosions at 31 locations between the Nevada Test Site and Ordway, Colorado. Studies of these recordings show that the frequency content of the $\overline{P}$ wave is constant at about 3 cps for the first one or two seconds of recording. At larger distances the later part of the phase contains lower frequencies, down to 1 to 1 1/2 cps. The frequency of $\overline{P}$ does not change noticeably from one shot to another. The predominant frequency of Pg out to about 150 km is about 4 cps. The frequency content of Pn is primarily source-dependent and is not observed to behave regularly as a function of distance. Frequencies for Pn varied from 2.2 to 4 cps, and were fairly constant for a given explosion.

GASSMANN, F., "Seismic Determination of an Inclined Interface of Unknown Direction of Gradient," Beitr. Angew. Geophys., Vol. 4, pp. 358-363, 1934, (Translated from German), Contract SD-78.

VESIAC 9528 VU

Equations are derived for the seismic determination of the depth and inclination of a sloping interface between a superficial and a covered medium, where the direction of the gradient is assumed to be unknown and is also determined. For the solution of this problem, profile shooting is used in four directions at a distance of 90° from each other.

GEHRELS, E., Interferometric Phase and Amplitude Fluctuation Measurements Over a 7-km Atmospheric Path, Tech. Note, Rept. No. TN 1969-28, ESD-TR-69-111, Contract AF 19(628)-5167, Lincoln Labs., M. I. T., Lexington, Mass., 1969

VESIAC 19,806 VU

A 6328 Å laser interferometer of the Michelson type has a one-way path length of 7 km. The fringes are resolved by frequency-modulating the laser sufficiently to sweep over at least one fringe width. By correlation techniques, the resulting fringe intensity pattern is resolved into the true fringe crossing direction and rate and into light amplitude fluctuations. An upper limit of 300 per second is established for the former, the amplitude fluctuations being at a slower rate. With a measured intensity range of up to 5000:1, it is clear from the data that none of the currently postulated Rayleigh, log normal, or Rice distributions match the amplitude statistics over this full range. A limiting value of standard deviation for the log of the amplitude is 0.85.

GEHRELS, E., A Review of Long-Range Earth Strain Measurement Techniques for Providing Earthquake Warning, Rept. No. ESD-TR-65-564, Contract AF 19(628)-5167, Lincoln Laboratory, Mass. Inst. of Tech., Cambridge, Mass., 1965.

VESIAC 13,287 VU
AD 625 817

Geologists are now looking for minute telltale displacements that might occur before an earthquake. This report discusses the possible accuracies that might be achieved by three different electromagnetic measurement techniques: 1) microwave phase measurements; 2) modulated light beams; 3) laser interferometers. The first is very sensitive to propagation errors. The second can achieve a modest degree of accuracy; it will meet the minimum requirements. The third will provide by far the greatest degree of accuracy for propagation path lengths over which at least a partial degree of wave front coherence can be maintained.

GENERAL ATRONICS CORP. (STAFF), Large Aperture Seismic Arrays, First Quarterly Technical Report, Rept. No. ESD-TR-66-489, Contract AF 19(628)-5981, General Atronics Corp., Philadelphia, Pa., 1966

VESIAC 15,872 VU
AD 637 009

The work to date has dealt with the effect of seismometer placement on array sidelobes, the performance to be expected with arrays using one bit signals from the seismometers, the coherence of signals, noise, and coda across LASA, P-coda correlation as a discriminant, and the frequency dependence of attenuation in the earth's upper mantle.

GENERAL ATRONICS CORP. (STAFF), First Quarterly Technical Report - Large Aperture Seismic Arrays (LASA), ESD-TR-67-615, Contract F19628-67-C-0370, General Atronics Corp., Philadelphia, Pa., 1967.

VESIAC 17,136 VU
AD 662 632

Four topics are discussed in this Quarterly Progress Report. The first topic related to the "high-frequency" portion of LASA seismograms. The second topic is the problem of detecting underground nuclear tests in the presence of large natural events. The third topic is DIMUS processing of seismic array outputs. Finally, an extended version of an automatic pP test is discussed.

GENERAL ATRONICS CORP., (STAFF), Large Aperture Seismic Arrays, Second Quarterly Tech. Rept., June - Sept. 1966, Rept. No. ESD-TR-67-220, Contract AF 19(628)-5981, General Atronics Corp., Philadelphia, Pa., 1967.

VESIAC 15,907 VU
AD 649 681

This report describes the following three topics: a) the estimation of the spectra of transient signals with additive noise; b) the theoretical aspects of clustering seismometers in a large aperture seismic array and c) the results of tests of a revised automatic pP phase detection technique.

GENERAL ATRONICS CORP., (STAFF), Large Aperture Seismic Arrays, Third Quarterly Tech. Rept., Contract AF 19(628)-5981, General Atronics Corp., Philadelphia, Pa., 1967.

VESIAC 16,073 VU
AD 651 653

Preliminary results on spectral estimates of seismic events are presented and two principal conclusions are suggested: noise prediction is probably not a useful means of reducing the variability of spectral estimates, and, for the one large surface-focus event processed to date, there is a significant amount of signal energy above 4 Hz. The problem of detecting nuclear explosions in the presence of large natural events has also been considered with the emphasis on the possibility of "steering" nulls at the natural events. Finally, the location of epicenters by beam splitting with a LASA is discussed. The technique is described, the sources of error are analyzed, and the data from three seismic events are presented.

GENERAL ATRONICS CORP. (STAFF), Large Aperture Seismic Arrays, Final Rept., Contract AF 19(628)-5981, General Atronics Corp., Philadelphia, Pa., 1967.

VESIAC 16,642 VU
AD 657 349

Theoretical derivations and calculated array patterns are presented for the following seismic arrays: the existing LASA-Montana, a random array with an aperture comparable to LASA-Montana (200 km), and a continental-size array with an aperture of several thousand kilometers. The use of LASA-Montana for determining epicenters of seismic events is discussed and results are presented that indicate errors on the order of 60 kilometers. Two tests for identifying earthquakes with depths between 10 and 40 km are introduced, and experiments on approximately 40 seismic events, on which both tests performed quite well, are summarized. The possibility of using DIMUS processing on a seismic array is discussed. Calculations are presented based on the conventional DIMUS processing as well as on a modified DIMUS scheme that appears to be significantly better.

GENERAL ATRONICS CORP. (STAFF), Large Aperture Seismic Arrays (LASA), Second Quarterly Tech. Rept., Rept. No. ESD-TR-67-630, Contract AF 19628-67C-0370, General Atronics Corp., Philadelphia, Pa., 1968.

VESIAC 17,606 VU
AD 664 571

Four topics are discussed in this progress report. The first topic is related to the masking of underground nuclear tests with large earthquakes. The second topic deals with the effects of signal-to-noise ratio and local travel-time anomalies on the accuracy of epicenter location using large seismic arrays. The third topic deals with the application of a previously developed coda-correlation discriminant to DIMUS (hardlimited) seismograms. The fourth topic deals with the automatic identification of the phase of earthquakes, for events in the 40 to 150 km depth region.

GENERAL ATRONICS CORP. (STAFF), Large Aperture Seismic Arrays (LASA), Third Quarterly Technical Rept. No. ESD-TR-68-148, Contract AF 19(628)-67C-0370, General Atronics Corp., Philadelphia, Pa., 1968.

VESIAC 17,980 VU
AD 667 794

Four topics are discussed in this report. The first topic is the detection of underground nuclear explosions in the presence of large natural events. The second topic considered is the use of a LASA for estimating epicenters by beamforming and other methods. The third topic is an analysis of detection and false alarm probabilities for a DIMUS array. Finally, the previously developed automatic pP test has been re-examined with a view toward evaluating its performance and simplifying its implementation.

GENERAL ATRONICS CORP. (STAFF), Large Aperture Seismic Arrays, Final Rept., Rept. No. ESD-TR-68-410, Contract F19(628)-67C-0370, General Atronics Corp., Philadelphia, Pa., 1968

VESIAC 19,039 VU
AD 842 458

This is the Final Report on Contract AF19(628)-67-C-0370. Continued work on an automatic pP test and coda-correlation discriminant, both of which employ data from continental-size arrays, is reported. The possibility of utilizing the "high-frequency" (3-5 Hz) portion of the seismic spectrum for array processing is considered and rejected. Observations on Rayleigh wave data that relate to the possibility of using a simple time stretching to correct for dispersions across very large arrays are presented.

GENERAL ATRONICS CORP. (STAFF), Seismic System Studies, First Quarterly Rept., 12 May 1968 to 11 August 1968, Rept. No. ESD-TR-68-411, Contract F19628-68C-0338, General Atronics Corp., Philadelphia, Pa., 1968

VESIAC 19,022 VU
AD 844 452

This report deals with detection, location, and waveform estimation algorithms for use with a DIMUS processing system for large aperture seismic arrays. The report deals in part with the parameter choices in construction of these algorithms, and in part with first results of application of the algorithms to seismic signals.

GENERAL ATRONICS CORP (STAFF), Seismic Array Studies, First Quarterly Tech. Rept., Rept. No. ESD-TR-69-301, 1850-2087-1, Contract F19628-69C-0274, General Atronics Corp., Philadelphia, Pa., 1969

VESIAC 19,935 VU

This is the First Quarterly Technical Report on Contract F19628-69-C-0274. This report is concerned with evaluations of the detection and location ability on actual seismic data and the means of implementing a DIMUS seismic signal processor. To assist in obtaining realistic performance figures, LASA data from 36 seismic events have been processed. The detection system produced the eorrect responses for the events. Preliminary analysis of the loeation results, using the C&GS reports as a standard, has shown that the location error was less than 1^{o} for 75 percent of the events analyzed. Specifications for the overall system structure as well as much of the detailed beam-former-detector description are reported as part of the system definition. Lastly, the results of an analysis of the dependence of two short-period discriminants on array size are presented.

GENERAL ATRONICS CORP. (STAFF), Seismic Array Studies, Second Quarterly Tech. Rept., Rept. No. ESD-TR-70-64, Contract F19628-69C-0274, General Atronics Corp., Philadelphia, Pa., 1969

VESIAC 20,120 VU
AD 867 798

This report is concerned with the means of implementing a DIMUS seismic signal processor, with performance evaluations of the DIMUS detector, and with ways to improve the estimation ability of a DIMUS or DIMUS-oriented system. Theoretical results on a new approaeh for waveform estimation with DIMUS, termed "deliberate noise addition," which appear very promising are presented.

GENERAL ATRONICS CORP. (STAFF), Seismic Array Studies, Third Quarterly Teeh. Rept., Rept. No. ESD-TR-70-279, 1984-2087-8, Contract F19628-69C-0274, General Atronics Corp., Philadelphia, Pa., 1970

VESIAC 20,342 VU
AD 874 299

This report presents the results of further effort directed towards the specification of the means of implementing a DIMUS processor for the detection, location, and identification of seismic signals. Additional results on the DIMUS deliberate-noise-addition estimation scheme are presented. These results deal with the potential use of data interpolation and the combined use of several subarrays, each with a different deliberate noise figure. A simplified stochastic model of P wave coda signals is presented. This model, which is to be used in detection capability analyses, is based both on theoretical assumptions and empirical data from four shallow-focus earthquakes.

GENERAL ATRONICS CORP. (STAFF), Seismic System Studies, Second Quarterly Tech. Rept., Rept. No. ESD-TR-69-51, Contract F19628-68C-0338, General Atronics Corp., Philadelphia, Pa., 1969

VESIAC 19,312 VU

This is the Second Quarterly Technical Report on Contract F19628-68-C-0338. Continuing efforts to extend and refine detection, location, and waveform estimation algorithms for use with a DIMUS processing system for large aperture seismic arrays are discussed.

The report deals with parameter choices in construction of these algorithms, further experiments with these algorithms to substantiate earlier results and preliminary results from applying revised algorithms to seismic signals. Simulations employing seismograms with artificially lowered signal-to-noise ratios have been employed to study the behavior of these algorithms. Based on simulations with one event, results with a 119-element DIMUS array show the DIMUS energy detector to be about 2 dB less sensitive than the corresponding "analog" (unclipped) system. 54-element location results with a new event indicate the DIMUS processor is performing less well than found earlier in comparison with the analog system. A revised algorithm for waveform estimation provides modest improvements in theoretical performance and substantial improvements in actual experimental results.

GENERAL ATRONICS CORP. (STAFF), Seismic System Studies, Third Quarterly Rept., 12 November 1968 to 11 Feb. 1969, Rept. No. ESD-TR-69-126, Contract F19628-68C-0338, General Atronics Corp., Philadelphia, Pa., 1969

VESIAC 19,673 VU
AD 854 117

This is the Third Quarterly Technical Report on Contract F19628-68-C-0338. The report describes further experimental and theoretical studies of DIMUS processing algorithms for use with a large aperture seismic array (LASA). Simulations with a second event confirm the earlier conclusion that a 119-element DIMUS array is about 2 dB less sensitive at the function of detection than the corresponding analog array; this conclusion is based on data filtered to the 0.75-1.75 Hz band before hardlimiting. Based on this filter, 119-element array experiments with one event indicate location accuracy with hardlimited data is excellent in comparison with the corresponding location accuracy using analog data. Waveform estimates using 119 elements demonstrate mild improvements over those derived from 54 elements, and such estimates perform well in conjunction with the standard complexity discriminant. One other topic, the systems aspects of array processing for long-period signals, is discussed. It is tentatively concluded that test site monitoring with long period arrays is possible from the United States.

GENERAL ATRONICS CORP. (STAFF), Seismic System Studies, Final Rept., Rept. No. ESD-TR-69-282, Vol. I, 1850-2062-11, Contract F19628-68C-0338, General Atronics, Corp., Philadelphia, Pa., 1969

VESIAC 19,916 VU
AD 861 677

This is the Final Report on Contract F19628-68-C-9338. This report considers detection, location, and waveform estimation algorithms for use with a DIMUS processing system for large aperture seismic arrays. The report deals in part with the parameter choices in construction of the algorithms, and in part with the results of applying these algorithms to seismic signals. Experiments have made use of seismograms with artificially lowered signal-to-noise ratios. It was found experimentally that a 119-element DIMUS array is 2 dB less sensitive for detection than the corresponding analog array. The location performance of the DIMUS and analog processors are comparable. A good estimate of the seismogram is obtained if a small number of analog channels are used in addition to the hardlimited channels.

GENERAL MOTORS CORP., (STAFF), Portable Field Recording System, Tech. Rept., Rept. No. TR 68-15, Contract Nonr 4298 (00) General Motors Corp., Santa Barbara, Calif., 1968.

VESIAC 18,003 VU

This report describes the Portable Field Recording System as a multi-channel device that will record, unattended, for 24 hours in a frequency band from dc to 313 Hz. The system can operate without preempting a patch panel terminal, because female connectors are pigtailed in parallel with each signal input cable jack.

GENERAL MOTORS DEFENSE RESEARCH LABORATORY (STAFF), Portable Field Recording System, Tech. Rept. No. 66-18, Contract NOnr-4298(00), General Motors Def. Res. Lab., Santa Barbara, Calif., 1966.

VESIAC 14,463 VU

The Portable Field Recording System is a multi-channel device that will record, unattended, for 24 hours in a frequency band from dc to 313 Hz. The system can operate without preempting a patch panel terminal, because female connectors are pigtailed in parallel with each signal input cable jack. Prime power for the system can be furnished by either a 12-vdc source or a 115-vac, 60-cycle source.

GERLACH, G., J. H. HAMILTON and B. B. LEICHLITER, Visual Analysis of Data from Arrays at the Wichita Mountains Seismological Observatory, Contract No. ARPA Agency Document, Geotechnical Corp., Garland, Texas, 1963 (OFFICIAL USE ONLY).

VESIAC 7351 C VU O

GEOTECHNICAL CORP. (STAFF), Advantages of Seismic Data Filters, Geotech Models 11760 and 12025, in Preliminary Seismic Analysis, Contract VT/036, AF 33(657)-12007, Geotechnical Corp., Garland, Texas, 1963.

VESIAC 7545 VU

A Seismic Data Filter, Geotech Model 11760 or 12025, has been used at four seismological observatories for at least 6 months. The summation of the outputs of the short-period array seismometers at each observatory drives the filter. Attenuation of low-frequency microseisms by the seismic data filter makes it practical to increase the magnification of the filtered summation system over the unfiltered summation system by a factor of two to three. The cutoff points of the passband and the cutoff rates are determined at the observatory and vary with the nature of the low-frequency microseisms dominant at each site. The major advantages of the filtered summation seismograph in preliminary seismic analysis are given.

GEOTECHNICAL CORP. (STAFF), Analyst's Handbook, Technical Rept. No. 64-51, Project VT/036, AF 33(657)-12007, The Geotech. Corp., Garland, Texas, 1964.

VESIAC 8976 VU

This Geotech handbook contains aids for analysis of seismological data which were devised or collected by Geotech personnel. It includes, in part, a P-wave direction determination chart, determination of direction using Rayleigh waves, definition of earthquake zones, numerous basis travel-time tables, quick reference distance determination tables for principal earthquake phases, focal depth determination tables, summaries of observed Love and Rayleigh wave dispersion, and numerous other useful items.

GEOTECHNICAL CORP. (STAFF), Atlas of Signals and Noise. Contr. No. VT/036, AF 33(657)-12007, Geotechnical Corp., Garland, Texas, 1964.

VESIAC 8039 VU
AD 480 402

This atlas is designed as a guide for those interested in the signals recorded at the Wichita Mts. Seism. Observatory (WMSO). Examples of signals, phases, and noise are included. In many instances, the examples may be considered typical; however, because of the nature of several of the subjects, some of the examples given must be considered atypical. Reference to this atlas should provide assistance to those engaged in routine analysis of WMSO seismograms by illustrating the many different characteristics of signal and noise on the seismograms. In the introductory section of the atlas, orientation of instrument arrays at WMSO is presented.

GEOTECHNICAL CORP. (STAFF), Atlas of Signals and Noise, Tech. Rept. No. 65-71, Contract VT/4051, Geotechnical Corporation, Garland, Texas, 1965

VESIAC 13,017 VU

Earthquake signals and noise recorded by three LRSM mobile laboratories during the fall and winter months of 1964 are surveyed. This report is a visual aid to seismologists and analysts interested in the character of seismic events recorded at sites in West Germany, Bolivia, and Norway.

A wide selection of signals from the short-period as well as the long-period seismographs operating at these sites is shown. Seismograph response data and recent noise study information are included with each set of station data.

GEOTECHNICAL CORP. (STAFF), Comparison of the Seismic Data Filter, Geotech Model 11760, and the Modified Ultra Low Frequency Band-Pass Filter, Krohn-Hite Model 330-A, Contract VT/036, AF 33(657)-12007, Geotechnical Corp., Garland, Texas, 1963.

VESIAC 7544 VU

Operating characteristics of the Seismic Data Filter, Geotech Model 11760, and the modified Ultra Low Frequency Band-Pass Filter, Krohn-Hite Model 330-A, were compared at the Wichita Mountains Seismological Observatory during the period 28 October to 19 November 1963. Operation under identical conditions showed the filters to be of equal value for routine seismic analysis. Special tests showed the Krohn-Hite filter to have 18 db more filter noise and 12 db less dynamic range than the Geotech filter.

GEOTECHNICAL CORP. (STAFF), Composite Record Discussion, ARMADILLO, Long-Range Seismic Measurements Program, Contr. No. VT/4051, AF 33(657)-12145, Geotechnical Corp., Garland, Texas, 1963.

VESIAC 8278 VU

This report describes the magnetic tape composite record of the ARMADILLO event. Data for the composite were taken from the

40 field teams operated by Geotech and from the Wichita Mts. Seismological Observatory. The report falls into four sections: 1) a description of the content and format of a standard LRSM composite record; 2) information on LRSM systems and procedures that may be helpful in interpreting the data in the composite; 3) a detailed account of the ARMADILLO composite: emphasizing any deviations from the standards: a tabular summary of the data is provided, along with a form showing the magnetic tape channel assignments for this event, and information on each of the sites that recorded data for this composite; and 4) a description of the ARMADILLO event.

GEOTECHNICAL CORP. (STAFF), Composite Record Discussion BOBAC, Long-Range Seismic Measurements Program, Contract VT 074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1963 (OFFICIAL USE ONLY).

VESIAC 8274 VU O

GEOTECHNICAL CORP. (STAFF), Composite Record Discussion GNOME, Long-Range Seismic Measurements Program, Contract VT 074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1962.

VESIAC 7412 VU

This handbook has been prepared to provide a description of the composite records being prepared by the Geotechnical Corporation under Project VT 074. The information given includes a discussion of the composite records in general, a discussion pertaining to the details of a specific constant, and a description of the equipment and methods used to obtain the data. Table 1 lists the sites from which data were taken for this composite. Figure 1 shows the location of all sites occupied for the test. The site information is given in Table 2.

GEOTECHNICAL CORP. (STAFF), Composite Record Discussion - HARDHAT, Long-Range Seismic Measurements Program, Contr. No. VT/074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1963.

VESIAC 8268 VU

This handbook describes the composite record for the HARDHAT event. The information covers composite records in general, details of this specific composite, and a description of the equipment and methods used to obtain the data. Tables 1 and 2 lists the sites from which data were taken. The tables provide information concerning the data from each site and give the reference numbers identifying each segment of the data on film. Section 2 contains an explanation of the composite, including deviations from the standard composite format. This standard format is described in Section 3. Section 4 contains supplementary system information.

GEOTECHNICAL CORP. (STAFF), Composite Record Discussion, HOOSIC, Long-Range Seismic Measurements Program, Contr. No. VT 074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1962.

VESIAC 8277 VU

This handbook describes the composite record for the HOOSIC event. The information covers composite records in general, details of this specific composite, and a description of the equipment and methods used to obtain data. The report has three sections: 1) specific comments on the HOOSIC composite; 2) one 16-mm develocorder film record of the short-period data; a table gives information on the data from each site and gives the reference numbers identifying each segment of the data on film; and 3) supplementary information; the calibration data sheet provides all the data required for computing magnifications at each site, using either the ball-lift or sine-wave calibrations.

GEOTECHNICAL CORP. (STAFF). Composite Record Discussion HYRAX. Long-Range Seismic Measurements Program, Contract VT 074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1963 (OFFICIAL USE ONLY).

VESIAC 8270 VU O

GEOTECHNICAL CORP. (STAFF). Composite Record Discussion JOHNNIE BOY. Long-Range Seismic Measurements Program, Contract VT 074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1963 (OFFICIAL USE ONLY).

VESIAC 8272 VU O

GEOTECHNICAL CORP. (STAFF). Composite Record Discussion LITTLE FELLER I. Long-Range Seismic Measurements Program, Contract VT 074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1963 (OFFICIAL USE ONLY).

VESIAC 8276 VU O

GEOTECHNICAL CORP. (STAFF). Composite Record Discussion LITTLE FELLER II. Long-Range Seismic Measurements Program, Contract VT 074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1963 (OFFICIAL USE ONLY).

VESIAC 8273 VU O

GEOTECHNICAL CORP. (STAFF). Composite Record Discussion MADISON. Long-Range Seismic Measurements Program, Tech. Rept., Contract No. VT 074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1963.

VESIAC 7405 VU

This handbook describes the composite record for the MADISON event, and was prepared by the Geotech Corporation. It covers composite records in general, details of this specific composite, and a description of the equipment and methods used to obtain the data. Preparation of the magnetic tape composite is described. Advantages are given to having selected segments of data from some forty reels of tape re-recorded on to a single reel. A typical composite is described; calibration data for a composite record are described, as well as seismic data. Table 1 lists the sites from which data were taken. Section 2 contains a detailed explanation of the composite. Section 3 gives the standard format; Section 4 gives supplementary information.

GEOTECHNICAL CORP. (STAFF), Composite Record Discussion PEBA, Long-Range Seismic Measurements Program, Contract VT/074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1963 (OFFICIAL USE ONLY).

VESIAC 8269 VU O

GEOTECHNICAL CORP. (STAFF), Composite Record Discussion PLATTE, Long-Range Seismic Measurements Program, Contract No. VT/074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1962.

VESIAC 7413 VU

This handbook describes the composite records being prepared by the Geotechnical Corporation under Project VT/074. The information given includes a discussion of composite records in general, details of a specific composite, and a description of the equipment and methods used to obtain this data. Table I lists the sites from which data were taken for this composite. Section 2 contains a detailed explanation of the composite, including deviations from a standard composite format. The standard format is described in Section 3. Section 4 contains supplementary system information.

GEOTECHNICAL CORP. (STAFF), Composite Record Discussion - STILLWATER, Long-Range Seismic Measurements Program, Contr. No. VT/4051, AF 33(657)-12145, Geotechnical Corp., Garland, Texas, 1963.

VESIAC 8267 VU

This handbook describes the magnetic tape composite record of the STILLWATER event. Section 2 describes the content and format of a standard LRSM composite record. It discusses the magnetic tape record, the 16-mm film playout of short-period data, and the operational logs prepared by the field teams. Section 3 provides information on LRSM systems and procedures that may be helpful in interpreting the data in the composite. Section 4 discusses the STILLWATER composite in detail. In Section 4, a tabular summary of the data is provided, with a form showing the magnetic tape channel assignments for this event. Also included is information on each of the sites occupied for this event. Section 5 gives a description of STILLWATER.

GEOTECHNICAL CORP. (STAFF), Composite Record Discussion WICHITA, Long-Range Seismic Measurements Program, Contract VT/074, AF 33(600)-41694 Geotechnical Corp., Garland, Texas, 1963 (OFFICIAL USE ONLY).

VESIAC 8275 VU O

GEOTECHNICAL CORP. (STAFF), Composite Record Discussion YORK, Long-Range Seismic Measurements Program, Contract VT/074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1963 (OFFICIAL USE ONLY).

VESIAC 8271 VU O

GEOTECHNICAL CORP. (STAFF), Data for Preliminary Planning of Large Borehole Array, Technical Report 64-67, Project VT/4051, Contract AF 33(657)-12145, Geotechnical Corp., Garland, Texas, 1964.

VESIAC 15,894 VU
AD 482 924

It is proposed that a large array of seismographs in shallow boreholes dispersed over an area of several hundred square kilometers would improve the detection and identification of small seismic signals. The purpose of this report is to provide background information on instruments, sites, and installation techniques applicable to a large borehole array.

GEOTECHNICAL CORP. (STAFF), Deep-Hole Site Report Assman Nos. 1 and 2, Tripp County, South Dakota, Tech. Rept. No. 64-131, Project VT/4051, (AFTAC), Contract 33(657)-12145, Geotech. Corp., Garland, Texas, 1964.

VESIAC 9610 VU

The Assman Nos. 1 and 2, located in south central South Dakota, were drilled as experimental test holes. The Assman No. 1 was drilled to a total depth of 305 m (1000 ft) and penetrated a continuous section of low-velocity sediments of Tertiary and Cretaceous age. The Assman No. 2 was drilled at the same site to a total depth of 61 m (200 ft), and was bottomed in low-velocity Tertiary sediments. Results of measurements in these holes indicate that the noise level decreased by a factor of 5, whereas the signal-to-noise only improved by a factor of 2 because of the decrease in signal amplitude with depth.

GEOTECHNICAL CORP. (STAFF), Deep-Hole Site Report, Meridian Unit No. 1 Well, White Pine County, Nevada, Contr. No. VT 1139, AF 33(600)-43369, Geotechnical Corp., Garland, Texas, 1964.

VESIAC 8867 VU

The Meridian Unit No. 1, White Pine County, Nevada, was prepared for use in a deep-hole measurement program. The hole, originally drilled by Continental Oil Company, penetrates into the Hanson Creek formation (Ordovician) and has a total useable depth of 3130 m (10,300 ft.). Deep-hole and surface seismographs were used to enhance the performance of the seismographs. Results of the measurements show that a signal-to-noise improvement of 1.5 is obtained at a depth of 2100 m (7000 ft).

GEOTECHNICAL CORP. (STAFF), Deep-Hole Site Report Sponaugle No. 1, Pendleton County, West Virginia, Tech. Rept. No. 64-102, Project VT/1139, Contract No. AF 33(600)-43369, Geotech. Corp., Garland, Texas, 1964.

VESIAC 8873 VU

The Sponaugle No. 1 was prepared for use in a deep-hole measurement program. It was originally drilled by United Fuel Gas Company and penetrates Ordovician and Cambrian sediments to its total depth of 3963 m (13,001 ft). Deep-hole and surface seismographs were used to make measurements. Results of the measurements show that the noise decreased slowly with depth. Spectral analysis indicated that the presence of higher-mode Rayleigh waves was responsible for this behavior. No improvement in the signal-to-noise ratio was obtained at depth.

GEOTECHNICAL CORP. (STAFF), Deep-Hole Site Report, Tabernacle Butte No. 1, Sublette County, Wyoming, Contr. No. VT 1139, AF 33(600)-43369, Geotechnical Corp., Garland, Texas, 1964.

VESIAC 8868 VU

The Tabernacle Butte No. 1, Sublette County, Wyoming, was prepared for use in a deep-hole measurement program. The deep hole, originally drilled by Texaco, Inc., penetrates the Wasatch and Fort Union formations, and bottoms in the Lance formation (Cretaceous) at a total usable depth of 3033 m (9950 ft). A Shallow hole with a depth of 61 m (200 ft), was prepared for comparison purposes. Deep-hole, shallow-hole, and surface seismographs were used to make measurements. Results of the measurements show that, in this quiet location, the 61-m (200 ft) hole allows great attenuation of wind-induced noise, and the signal-to-noise improvement is as great as in the deep hole.

GEOTECHNICAL CORP. (STAFF), Deep-Hole Site Report Trigg No. 1, Dallas County Texas, Tech. Rept. No. 64-100, Project VT/1139, Contract No. AF 33(600)-43369, Geotech. Corp., Garland, Texas, 1964.

VESIAC 8871 VU

The Trigg No. 1, Dallas County, Texas, was prepared for use in a deep-hole seismograph development and measurement program. It penetrates into the Ellenburger formation (Ordovician), and has a total usable depth of 3118 m (10,231 ft). A 152-m (500-ft) shallow hole was prepared for use in instrument testing work, and includes a 1.8 m (6 ft) diameter by 6 m (20 ft) long tank welded to the casing and buried flush with the surface. There are two other shallow holes at the sites, each 23 m (75 ft) deep. The noise is decreased by a factor of 25 at the bottom of the deep hole compared to the surface. The signal-to-noise ratio improvement obtained varies between factors of 5.0 and 8.5, depending on way of depth signal amplitude measurement.

GEOTECHNICAL CORP. (STAFF), Deep-Hole Site Report USA No. 1, Uintah County, Utah, Rept. No. 64-101, Project VT/1139, Contract No. AF 33(600)-43369, Geotech. Corp., Garland, Texas, 1964.

VESIAC 8872 VU

The U. S. A. No. 1, Uintah County, Utah, is located near the Uinta Basin Seismological Observatory. It was prepared for deep-hole measurements for purposes of signal comparisons with the surface array. This deep hole originally drilled by Carter Oil Company, penetrates a continuous section of low-velocity Tertiary sediments to its total depth of 2745 m (9007 ft). Deep-hole seismographs were used to make measurements and the results were recorded at the observatory. Results of measurements show that a small improvement in signal-to-noise ratio (by a factor between 1.5 and 2.0) is obtained at depths between 1200 m and 1800 m (4000 ft and 6000 ft).

GEOTECHNICAL CORP. (STAFF), Deep-Well Site Report Eniwetok E-1 Well, Parry Island, Eniwetok Atoll, Marshall Islands, Pacific Ocean, Tech. Rept. 63-118, Contract VT/1139, AF 33 (600)-43369, Geotech. Corp., Garland, Texas, 1964.

VESIAC 10,770 VU

The Eniwetok E-1 Well, Parry Island, Eniwetok Atoll, Marshall Islands, Pacific Ocean, was prepared for use in a deep-well measurement program. The well, originally completed by the Atomic Energy Commission, penetrates to olivine basalt at a depth of 1288 m (4225 ft). A deep-well seismograph and surface seismographs were used to make measurements. Results of the measurements show that a small improvement in signal-to-noise ratio is possible by operating in the well.

GEOTECHNICAL CORP. (STAFF), Deep-Well Site Report Perdasofpy No. 1 Well, Comanche County, Oklahoma, TR 64-108, Contract VT/1139, AF 33(600)-43369, Geotech. Corp., Garland, Texas, 1964.

VESIAC 10,772 VU

The Perdasofpy No. 1 well, Comanche County, Oklahoma, was prepared for use in a deep-well measurement program. The well, originally drilled by Stanolind Oil and Gas Company, penetrates an igneous basement complex from 1664 m (5460 ft) to a depth of 2949 m (9674 ft). Deep-well and surface seismographs were used to make measurements. Results of the measurements show that the predominant 0.5-sec noise decreases only slowly with depth. The signal-to-noise ratio at the bottom of the well is slightly better than at the surface. Signal analysis with two seismometers in the well is used to improve detection.

GEOTECHNICAL CORP. (STAFF), Deep Well Site Report Terry No. 1 Well, Orange County, Florida, TR 63-88, Contract VT/1139, AF 33(600)-43369, Geotech. Corp., Garland, Texas, 1963.

VESIAC 10,771 VU

The Terry No. 1 Deep Well in Orange County, Florida, has been prepared for use in a deep-well measurement program. The history and geology of the well are given. The deep well and surface instrumentation is described, typical recorded events are illustrated, and results of analysis of records are described.

GEOTECHNICAL CORPORATION (STAFF), Deep-Well Variable Reluctance Seismometer Design and Field Test Program, Project VT/1139, Contract AF 33(600)-43369, The Geotech. Corp., Garland, Texas, 1964.

VESIAC 10,002 VU

The report discusses the design and testing of a seismometer to detect and identify signals of a lower amplitude than the 1-2 millimicrons presently detectable by a ten-element array with direct summation of a quiet location. It would record small teleseismic signals without the use of more instruments in the array or special techniques for processing the data derived therefrom. It must be stable, and operable for a long time under the severe environment of a deep well. It is also valuable at field locations with high surface noise. The Geotechnical Corporation has designed such an instrument, and put it into use at Grapevine, Texas and Hobart, Oklahoma. The wells at each site, the stations, and the relation of the seismometer to the amplifier are described.

GEOTECHNICAL CORP. (STAFF), Discussion of the Second Composite Record of GNOME (with Extended Time-Base Film Playout), Contract VT/074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1964.

VESIAC 7414 VU

In preparing a magnetic tape composite, selected segments of data from some 40 reels of tape are re-recorded on to a single reel of tape. Advantages of this procedure are given. A composite contains data from about 40 stations, in order of increasing distance from the shot site. A standard composite record's calibration data is described. Approximately 30 minutes of data are recorded from each station. Fourteen channels of data are recorded. The data is recorded in the field on an Ampex Model 314 14-channel magnetic tape system and is frequency-modulated with a 270-cps center frequency carrier. Re-recording on to the composite tape is described. Other matters are discussed: a) the making of a copy; b) the making of a develocorder film record; and c) other subjects.

GEOTECHNICAL CORP. (STAFF), Gravity and Magnetic Survey of the Area Within and Surrounding the Wichita Mountains Seismological Observatory Seismometer Array, Contr. No. VT/036, AF 33(657)-12007, Geotechnical Corp., Garland, Texas, 1964.

VESIAC 8856 VU
AD 451 283

A two-phase gravity and magnetic survey was made of the Wichita Mts. area of southwestern Oklahoma. Phase I was a vertical magnetic and gravity survey of the northwest corner of the Mt. Scott, 7.5' quadrangle. Phase II was a regional gravity and vertical magnetic intensity survey of the southwestern part of Oklahoma and a portion of northwest Texas. Seven traverses were made radiating from WMSO. The station spacing on these traverses was approximately 4 miles. Two main findings of these investigations, fully discussed in the report are: a) the Wichita Mts. area shows a positive Bouguer anomaly; and b) the Wichita Mts. are a magnetically high area with respect to the surrounding sedimentary basins.

GEOTECHNICAL CORP. (STAFF), "HARRIS" Galvanometer Temperature Test, Contr. No. VT/072, AF 33(600)-41824, Geotechnical Corp., Garland, Texas, 1962.

VESIAC 7727 VU

These tests were conducted to determine the quantitative spot-position drift of a Harris Galvanometer (Geotech Model 8530) during environmental temperature change between plus 32° and plus 120°F. The tests and results are described. A record of the temperature stability is presented. Adequate performance can be expected in earth-powered systems while using galvanometers with open-cap access holes. For best short-term stability, especially when the galvanometer is used in a phototube amplifier, the cap-access holes should be closed.

GEOTECHNICAL CORP. (STAFF), Improved Seismographs, Semiannual Progress Rept. No. 6, Contr. No. VT/072, AF 33(657)-9967, Geotechnical Corp., Garland, Texas, 1964.

VESIAC 7695 VU

Progress on the following work is presented: a) Inclined Seismometers, b) Galvanometers, c) Filtering, d) Amplifiers, e) Digitizer, f) New Methods of Signal Presentation, g) Improved Seismograph Testing Facilities, h) Stable Table, i) Strain Seismograph, and j) Experimental Investigation of Thermal Noise.

GEOTECHNICAL CORP. (STAFF), Interim Report on Operating Procedures on Project VT/074, Sept. 1961 to Dec. 1962, Contract No. VT/074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1963.

VESIAC 7329 VU

The quality of seismograph data has continually improved since the LRSM teams moved to the field in October, 1961. Operating procedures have been improved with the objectives of improving data quality and reducing the man-hours required to operate the systems. Studies have been conducted on long- and short-period systems calibration methods. Also studied were other aspects of the operating procedures: a) atmospheric pressure and temperature changes can produce noise on the long-period seismograms; b) to protect long-period seismometers from normal ambient pressure changes, the vault pressure seal should have a time constant of at least 5 minutes; and c) the performance of the short-period phototube amplifiers has been highly satisfactory.

GEOTECHNICAL CORP. (STAFF), Interpretation of LRSM Seismic Data, Contract No. VT/074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1962.

VESIAC 7378 VU

Seismic data from the Long-Range Seismic Measurements field teams is compiled by the Geotechnical Corporation under Project VT/074. The forty LRSM teams operate identical seismograph systems consisting of both long-period and short-period instrumentation. The long- and short-period systems each consist of one vertical and two horizontal seismographs. All instruments are amplified by phototube amplifiers and all data channels are recorded on both 35-millimeter film and magnetic tape. The purpose of this manual is to provide the basic information required to interpret the data from the LRSM seismograph systems.

GEOTECHNICAL CORP. (STAFF), Long Range Seismic Measurements, Project 8.4, CLEARWATER, Contract No. VT/074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1963.

VESIAC 7241 VU

This report analyzes LRSM film seismograms recorded by 37 mobile units for the CLEARWATER event at the Nevada Test Site, October 16, 1963.

GEOTECHNICAL CORP. (STAFF), Long Range Seismic Measurements, CLEARWATER, Contr. No. VT/074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1964.

VESIAC 7570 VU
AD 427 125

This report provides an analysis of LRSM film seismograms, from 37 mobile field teams and 4 VELA observatories, of the CLEARWATER nuclear explosion. The report supplied information on the instrumentation and procedure of the recording process, including station site details, basis of unified magnitude computation and amplitude measurements. Sample seismograms of CLEARWATER are included.

GEOTECHNICAL CORP. (STAFF), Long Range Seismic Measurements, Project 8.4, FALLON EARTHQUAKE, Contract No. VT/074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1963.

VESIAC 7302 VU
AD 427 873

The purpose of this earthquake report is to provide an analysis of LRSM film seismograms from 31 mobile field teams and the Wichita

Mountains Seismological Observatory. The seismic data and results presented may prove useful to VELA-UNIFORM participants in developing methods of distinguishing between explosive and earthquake sources.

GEOTECHNICAL CORP. (STAFF), Long Range Seismic Measurements, Project 8.4, FALLON EARTHQUAKE, Contract VT/074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1964.

VESIAC 7558 VU
AD 433 228

This is an earthquake report on behalf of the U. S. Air Force to provide information which may be of value in the study of data from nuclear tests. In particular, this report is to provide an analysis of LRSM film seismograms from the 31 mobile field units, and the seismological observatory operated under VELA-UNIFORM Wichita Mountains Seismological Observatory. Instrumentation of the stations, station site information, and procedures for amplitude measurements are clarified. Average unified magnitude is 4.4. First motion criteria were applicable for three stations out to a distance of 300 km. Travel-time residuals for Pn or P phases were about as expected, scatter in the waves out to 200 km being associated with regional crustal variations.

GEOTECHNICAL CORP. (STAFF), Long Range Seismic Measurements, Project 8.4 - FORE, Contr. No. VT/2034, Geotechnical Corp., Garland, Texas, 1964.

VESIAC 7706 VU
AD 436 392

The purpose of the project was to record and analyze short-period and long-period seismic data from a planned series of U. S. underground nuclear tests. The report gives an analysis of LRSM film seismograms from 40 mobile field teams from various seismological observatories. Also included are tables, graphs and sample seismograms, as well as amplitude graphs for all the principle phases, travel time residuals, unified magnitudes where measurable, and measurements of all the principle phases.

GEOTECHNICAL CORP. (STAFF), LRSM, Project 8.4, HANDCAR, Tech. Rept. No. 65-10, Project VT/4051, Contract AF 33(657)-12145, Geotech. Corp., Garland, Texas, 1965.

VESIAC 10,135 VU
AD 459 491
AD 460 487

The purpose of this report is to provide an analysis of LRSM film seismograms of the HANDCAR event from the 38 mobile field teams, and the following experimental seismological observatories operated under VELA-UNIFORM: Wichita Mountains Seismological Observatory, Blue Mountains Seismological Observatory, Tonto Forest Seismological Observatory, Uinta Basin Seismological Observatory, and Cumberland Plateau Seismological Observatory.

GEOTECHNICAL CORP. (STAFF), Long Range Seismic Measurements, Project 8.4, STONES, Contract No. VT/074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1963.

VESIAC 7231 VU

This report analyzes LRSM film seismograms recorded by 34 mobile units and by WMSO for the STONES event at the Nevada Test Site, May 22, 1963.

GEOTECHNICAL CORP. (STAFF), Long Range Seismic Measurements, STONES, Contr. No. VT/074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1964.

VESIAC 7571 VU
AD 433 204

This report contains an analysis of LRSM film seismograms from the 34 mobile teams and the experimental seismological observatory operated under VELA-UNIFORM, Wichita Mts. Seismological Observ., of the STONES nuclear explosion. Included is information on the instrumentation, and the procedure of the recording process, including station site details, the basis of the unified magnitude computation and amplitude measurements. Sample seismograms of STONES are included.

GEOTECHNICAL CORP. (STAFF), Long-Range Seismic Measurements Program - Data Catalog, May 1962, Contract No. VT/074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1962.

VESIAC 7382 VU

This catalog is a compilation of all data records received by the Geotechnical Corporation, Garland, Texas, from the LRSM Program stations for May 1962. Data are recorded on both film and tape. Film and tape data are treated in separate sections and in chronological order. Each data channel and data trace is shown individually. Figure 3 is a map showing the locations of the LRSM teams during May 1962. Table 1 gives information about the sites.

GEOTECHNICAL CORP. (STAFF), Long-Range Seismic Measurements Program Data Catalog, June 1962, Contract No. VT/074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1962.

VESIAC 7387 VU

This catalog is a compilation of all data records received by the Geotechnical Corporation, Garland, Texas, from the LRSM Program stations for June 1962. Data are recorded on both film and tape. Film and tape data are treated in separate sections and in chronological order. Each data channel and data trace is shown individually. Figure 3 is a map showing the locations of 39 LRSM teams during June 1962. Table 1 gives information about the sites. Section 2 explains catalog entries.

GEOTECHNICAL CORP. (STAFF), Long-Range Seismic Measurements Program Data Catalog, July 1962, Contract No. VT/074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1962 (OFFICIAL USE ONLY).

VESIAC 7388 VU O

GEOTECHNICAL CORP. (STAFF), Long-Range Seismic Measurements Program Data Catalog, August 1962, Contract No. VT/074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1962 (OFFICIAL USE ONLY).

VESIAC 7389 VU O

GEOTECHNICAL CORP. (STAFF), Long-Range Seismic Measurements Program Data Catalog, September 1962, Contract No. VT/074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1962 (OFFICIAL USE ONLY).

VESIAC 7390 VU O

GEOTECHNICAL CORP. (STAFF), Long-Range Seismic Measurements Program Data Catalog, October 1962, Contract VT/074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1962 (OFFICIAL USE ONLY).

VESIAC 7391 VU O

GEOTECHNICAL CORP. (STAFF), Long-Range Seismic Measurements Program Data Catalog, November 1962, Contract No. VT/074, AF 33 (600)-41694, Geotechnical Corp., Garland, Texas, 1962 (OFFICIAL USE ONLY).

VESIAC 7392 VU O

GEOTECHNICAL CORP. (STAFF), Long-Range Seismic Measurements Program Data Catalog, December 1962, Contract No. VT/074, AF 33 (600)-41694, Geotechnical Corp., Garland, Texas, 1962 (OFFICIAL USE ONLY).

VESIAC 7393 VU O

GEOTECHNICAL CORP. (STAFF), Long-Range Seismic Measurements Program Data Catalog, January 1963, Contract No. VT/074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1963, (OFFICIAL USE ONLY)

VESIAC 7394 VU O

GEOTECHNICAL CORP. (STAFF), Long-Range Seismic Measurements Program Data Catalog, February 1963, Contract No. VT/074, AF 33 (600)-41694, Geotechnical Corp., Garland, Texas, 1963 (OFFICIAL USE ONLY).

VESIAC 7395 VU O

GEOTECHNICAL CORP. (STAFF), Long-Range Seismic Measurements Program Data Catalog, March 1963, Contract No. VT/074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1963, (OFFICIAL USE ONLY).

VESIAC 7396 VU O

GEOTECHNICAL CORP. (STAFF), Long-Range Seismic Measurements Program Data Catalog, April 1963, Contract No. VT/074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1963.

VESIAC 7397 VU

This catalog is a compilation of all data records received by the Geotech. Corp., Garland, Texas, from the LRSM Program stations for April 1963. Data are recorded on both film and tape. Film and tape data are treated in separate sections and in chronological order. Each channel and data trace is shown individually.

GEOTECHNICAL CORP. (STAFF), Long-Range Seismic Measurements Program Data Catalog, May 1963, Contract No. VT/074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1963.

VESIAC 7398 VU

This catalog is a compilation of all data records received by the Geotech. Corp., Garland, Texas, from the LRSM Program stations for May 1963. Data are recorded on both film and tape. Film and tape data are treated in separate sections and in chronological order. Each channel and data trace is shown individually.

GEOTECHNICAL CORP. (STAFF), Long-Range Seismic Measurements Program Data Catalog, July 1963, Contract No. VT/074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1963 (OFFICIAL USE ONLY).

VESIAC 7400 VU O

GEOTECHNICAL CORP. (STAFF), Long-Range Seismic Measurements Program Data Catalog, August 1963, Contract VT/074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1963 (OFFICIAL USE ONLY).

VESIAC 7140 VU O

GEOTECHNICAL CORP. (STAFF), Long-Range Seismic Measurements Program Data Catalog, September 1963, Contract No. VT/074, AF 33 (600)-41694, Geotechnical Corp., Garland, Texas, 1963.

VESIAC 7402 VU

This catalog is a compilation of all data records received by the Geotech. Corp., Garland, Texas, from the LRSM Program stations for September 1963. Data are recorded on both film and tape. Film and tape data are treated in separate sections an in chronological order. Each data channel and data trace is shown individually.

GEOTECHNICAL CORP. (STAFF), Long-Range Seismic Measurements Program Data Catalog, January 1964, Contract No. VT/074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1964. (OFFICIAL USE ONLY).

VESIAC 7407 VU O

GEOTECHNICAL CORP. (STAFF), Long Range Seismic Measurement Program - Seismological Bulletin No. 40 for April 1965, Contract VT/4051, AF 33(657)-12145, Geotech. Corp., Garland, Texas, 1965.

VESIAC 15,327 VU

This bulletin contains seismological data on earthquake phases recorded at 10 of the mobile seismological stations being operated by Geotech. Corp., under the LRSM Program. The bulletin is intended to be an aid to interested observers in determining the extent of the earthquake data contained in the records from these teams. The bulletin contains: (1) data on all the phases that have been associated with epicenters by the USC&GS; (2) data on the epicenters listed in the bulletin - as reported by the USC&GS; (3) arrival time, period, amplitude, and distance for phases not associated with USC&GS epicenters.

GEOTECHNICAL CORP. (STAFF), Long Range Seismic Measurement Program - Seismological Bulletin No. 42 for June 1965, Contract VT/4051, AF 33(657)-12145, Geotech Corp., Garland, Texas, 1965.

VESIAC 15,328 VU

This bulletin contains seismological data on earthquake phases recorded at 10 of the mobile seismological stations being operated by Geotech. Corp., under the LRSM Program. The bulletin is intended to be an aid to interested observers in determining the extent of the earthquake data contained in the records from these teams. The bulletin contains (1) data on all the phases that have been associated with epicenters by the USC&GS; (2) data on the epicenters listed in the bulletin - as reported by the USC&GS; (3) arrival time, period, amplitude, and distance for phases not associated with USC&GS epicenters.

GEOTECHNICAL CORP. (STAFF), Long Range Seismic Measurements Program - Seismological Bulletin No. 45 for September 1965, Contract VT/4051, AF 33(657)-12145, Geotech Corp., Garland, Texas, 1966.

VESIAC 15,329 VU

This bulletin contains seismological data on earthquake phases recorded at 10 of the mobile seismological stations being operated by Geotech. Corp., under the LRSM Program. The bulletin is intended to be an aid to interested observers in determining the extent of the earthquake data contained in the records from these teams. The bulletin contains: (1) data on all the phases that have been associated with epicenters by the USC&GS; (2) data on the epicenters listed in the bulletin - as reported by the USC&GS; (3) arrival time, period, amplitude, and distance for phases not associated with USC&GS epicenters.

GEOTECHNICAL CORP. (STAFF), Long Range Seismic Measurements Program - Seismological Bulletin No. 46 for October 1965, Contract VT/4051, AF 33(657)-12145, Geotech. Corp., Garland, Texas, 1966.

VESIAC 15,330 VU

This bulletin contains seismological data on earthquake phases recorded at 10 of the mobile seismological stations being operated by Geotech. Corp. under the LRSM Program. The bulletin is intended to be an aid to interested observers in determining the extent of the earthquake data contained in the records from these teams. The bulletin contains: (1) data on all the phases that have been associated with epicenters by the USC&GS; (2) data on the epicenters listed in the bulletin - as reported by the USC&GS; (3) arrival time, period, amplitude, and distance for phases not associated with USC&GS epicenters.

GEOTECHNICAL CORP. (STAFF), Long Range Seismic Measurements Report of Southeast Missouri Earthquakes, Tech. Rept. No. 63-92, Contract No. VT/074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1963.

VESIAC 7130 VU

Seismic data recorded by the Long Range Seismic Measurements network from 3 earthquakes occurring in Southeast Missouri during the Spring and early Summer of 1963 are presented and summarized in tabular and graphic form. Obvious differences in data between these earthquakes and explosions at the Nevada Test Site are discussed.

GEOTECHNICAL CORP. (STAFF), Magnetic Tape Composite of Project GNOME, Volunteer Team Reports, Tech. Rept., Contract No. VT/074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1963.

VESIAC 7407 VU

The unclassified nuclear test, GNOME, exploded near Carlsbad, New Mexico, on December 10, 1961, and was monitored by 43 seismograph teams cooperating in the Volunteer Team Program. Eleven teams recorded the GNOME signal on magnetic recorders. This report describes the methods used in the preparation of a magnetic tape composite of the GNOME signal. Data from the magnetic records are re-recorded onto a single reel of tape. Figure 1 gives the approximate location of 42 of the participating teams. Table 1 is a numerical index of the teams shown in Figure 1. Table 2 lists the 11 volunteer teams which submitted magnetic recordings, and gives their location and distance from the GNOME site. The composite was prepared by the Hale Instruments Company of Houston.

GEOTECHNICAL CORP. (STAFF), Magnitude Studies and Detection Capability Studies Conducted Under Project VT/036, Tech. Rept. No. 64-123, Project VT/036, Contract AF 33(657)-12007, The Geotech. Corp., Garland, Texas, 1964.

VESIAC 8968 VU
AD 452 843

Station magnitude corrections for BMSO, CPSO, TFSO, UBSO, and WMSO, are developed for several epicentral regions. Differences in corrections for each observatory and for the regions indicate azimuthal dependence of station corrections and/or inaccuracies in existing distance-depth magnitude correction factors. An estimate of detection capability of the stations and of the 5-observatory net for USC and GS-located earthquakes is given. A comparison of the variability of BMSO, CPSO, UBSO, and WMSO in P-wave magnitudes calculated from long-period data to the variability among P-wave magnitudes calculated from short-period data is given, and of P-wave ground velocities observed on the broad-band, flat-velocity seismograms at WMSO with P-wave ground velocities on short-period seismograms.

GEOTECHNICAL CORP. (STAFF), Registration of Earthquakes at Blue Mountains Seismological Observ., Cumberland Plateau, Tonto Forest, Uinta Basin, and Wichita Mts., Contract Nos. VT/036, VT/070, VT/1124, Geotechnical Corp., Garland, Texas, 1963.

VESIAC 7345 VU
AD 436 466

These bulletins contain the data on earthquake phases recorded at the five seism. observ. operated for the U. S. Dept. of Defense. They are intended to aid in determining the extent of the earthquake data recorded at each of the five observatories. The preliminary analysis of film seismograms was accomplished by the personnel at each observatory. Included are: a) all epicentral locations, origin times, and depths of foci which are obtained from the USC & GS Preliminary Determination of Epicenter Cards, published monthly; b) data for all phases that have been associated with the epicenters reported in USC & GS cards; and c) phase arrival data that cannot be associated with epicenters reported in the USC & GS cards.

GEOTECHNICAL CORP. (STAFF), Reproductions of Some Signals Received at the Grapevine, Texas Site, Contract VT/1139, AF 33(600)-43369, Geotechnical Corp., Garland, Texas, 1964.

VESIAC 7416 VU

The following signals are reproduced in this booklet: 1) develocorder records of Grapevine seismometers; 2) develocorder record of JM seismometer array at WMSO; 3) signals produced by deep-well seismometer (in sealed hole) by, a) putting a weight on a diaphragm covering the well top, and b) by blowing in a sealed well; 4) quarry blast records; and 5) event recorded by a deep-well seismometer.

GEOTECHNICAL CORP. (STAFF), Reproductions of Some Signals Recorded at Hobart, Oklahoma, Contract VT/1139, AF 33(600)-43369, Geotechnical Corp., Garland, Texas, 1964.

VESIAC 7415 VU

This booklet contains a collection of photographs, and seismogram reproductions. There are photographs of a deepwell seismometer, Geotech Model 11167. Seismogram reproductions are: 1) develocorder record of small Benioff, deepwell and shallow-well seismometers at Hobart; 2) quarry blasts from Chico, Texas; 3) surface noise recorded by surface instruments only; and 4) develocorder record of regional signal, recorded by small Benioff, deep-well, and shallow-well seismometers at Hobart, Oklahoma.

GEOTECHNICAL CORP. (STAFF), Seismological Bulletin 1964: Long-Range Seismic Measurements Program, Contract VT/6703, AF 33 (657)-16270, Geotechnical Corp., Garland, Texas, 1964.

VESIAC 10,649 VU

This bulletin contains seismological data on earthquake phases recorded at 11 of the mobile seismological stations being operated by Teledyne Industries, Geotech Division, of the Long-Range Seismic Measurements (LRSM) Program. The bulletin is intended to be an aid to interested observers in determining the extent of the earthquake data contained in the records from these teams.

GEOTECHNICAL CORP. (STAFF), Special Orientation Program, Phase I, Tech. Rept. No. 64-132, Contract AF 49(638)-1150, The Geotech. Corp., Garland, Texas, 1964.

VESIAC 9966 VU

In June 1944, Geotech outlined a five-point orientation program for the training of new station researchers in the operation of seismological laboratories. The program was part of the plans to transfer several long-range Seismic Measurements Mobile seismological observatories to other U. S. government agencies and to several foreign countries. The program's five main points were: (1) preparation; (2) formal classroom instruction on equipment operation; (3) system setup exercises; (4) on-site visits; and (5) publication of a Signal Atlas of earthquake signals recorded at LRSM sites in Bolivia, Germany and Norway. Basic objectives of the orientation program (which were achieved), and recommendations for similar future programs are included.

GEOTECHNICAL CORP. (STAFF), Spectral Analysis of Seismic Noise at the Eniwetok E-1 Well, Parry Island, Eniwetok Atoll, Marshall Islands, Pacific Ocean, Contract No. VT/1139, AF 33(600)-43369, Geotechnical Corp., Garland, Texas, 1964.

VESIAC 8436 VU
AD 436 830

The power spectral density functions of seismic background noise were analyzed from several depths in the Eniwetok E-1 Well, Parry Island, Eniwetok Atoll, Marshall Islands. The theory of power spectra is discussed together with its application to the study of seismic background noise. Results obtained show that the noise recorded by a vertical-motion seismometer is due to Rayleigh waves, of fundamental and higher modes.

GEOTECHNICAL CORP. (STAFF), Spectral Analysis of Seismic Noise at the Perdasofphy No. 1 Deep Hole, Comanche County, Oklahoma, TR 64-83, Contract VT/1139, AF 33(600)-43369, Geotech. Corp., Garland, Texas, 1964.

VESIAC 10,773 VU

The power spectral density functions of seismic background noise were analyzed from a number of depths in the Perdasofphy No. 1 deep hole, Comanche County, Oklahoma. The theory of random body-wave noise is discussed, together with its application to the study of seismic background noise. Results obtained show that the noise recorded by a vertical-motion seismometer can be explained by a combination of Rayleigh waves of fundamental and higher modes, and body-wave noise.

GEOTECHNICAL CORP. (STAFF), Standard Operating Procedures for Seismological Observatories, Contract No. VT/036, AF 33(657)-12007, Geotechnical Corp., Garland, Texas, 1964.

VFSIAC 8418 VU

This manual of Standard Operating Procedures contains instructions for the operation of a seismological observatory. The procedures specified in the manual are those in use at the Blue Mts., Cumberland Plateau, Uinta Basin, and Wichita Mts. Seismological Observatories, (BMSO, CPSO, UBSO, and WMSO). Facets of observatory operation are described in detail, except for those specific instruments (for example, instrument repairs) that have been published in operation and maintenance (O & M) manuals. Reference is made to these manuals where appropriate.

GEOTECHNICAL CORP. (STAFF), Test Report, LRSM Seismograph Calibration Study, Contr. No. VT/074, AF 33(600)-41694, Geotechnical Corp., Garland, Texas, 1963.

VESIAC 8279 VU

Since the beginning of the Long-Range Seismic Measurements (LRSM) Program, a systematic discrepancy has been noted in the magnification calculations for the short-period seismographs. The magnifications computed from the weight lift method of calibration were consistently higher than those computed from the electromagnetic method of calibration. This calibration study resulted in recommendations for changes in the magnification constants, electromagnetic calibrator hardware, and in calibration techniques. In addition, the phase response characteristics of both the long-period and the short-period seismographs were produced and the long-period seismograph amplitude response characteristics and calibration techniques were verified.

GEOTECHNICAL CORP. (STAFF), Unattended Seismograph Unit, Tech. Rept. No. 63-5, Contract No. VT/036, AF 33(600)-41318, Geotechnical Corp., Garland, Texas, 1963.

VESIAC 6011 VU

This report presents a preliminary design, installation requirements, and time factors for an unattended seismograph unit capable of operation at a remote site in the USSR for periods of ninety days.

GEOTECHNICAL CORP. (STAFF), Wichita Mountains Seismological Observatory, Information Bulletin No. 1, Contract No. VT/036, AF 33 (600)-41318, Geotechnical Corp., Garland, Texas, 1961.

VESIAC 6805 VU

This bulletin provides information on Wichita Mountains Seismological Observatory, located in the foothills of the Wichita Mountains, about 15 miles northwest of Lawton, Oklahoma. Described are: a) the layout, b) instrumentation response characteristics, c) vaults and seismometers, d) amplifiers, e) data control, timing and power, f) recording, g) seismograms, h) conclusions, which state that this Observatory is well equipped and is located at a site with a low background noise. Also, continuous spectrum analysis of noise and signals, and detailed analysis of significant seismic events recorded on magnetic tape should be very informative. The station is located at a convenient distance from California and Mexican earthquakes.

GIBBS, J. F., and J. C. ROLLER, Seismic-Refraction Measurements of Crustal Structure Between Nevada Test Site and Ludlow, California, Technical Letter No. 26, Contract ARPA Order No. 193-64, U. S. Geological Survey, Denver Colorado, 1964. (OFFICIAL USE ONLY)

VESIAC 8881 VU O

GIBBS, J. F. and J. C. ROLLER, Seismic-Refraction Measurements of Crustal Structure Between Nevada Test Site and Ludlow, California, Contr. No. ARPA Order No. 193-64, U. S. Geol. Survey, Denver, Colo., 1964.

VESIAC 8561 VU
AD 451 866

Seismic refraction measurements were made from nuclear and chemical explosions along a line from the Nevada Test Site (NTS) to Ludlow, California, and additional recordings from nuclear explosions were made southward toward Calexico, California. Given are the expressions for the time of first arrival times. The difference in apparent velocities of the Pn (T3) arrival is caused by variations in the dip of the Mohorovicic Discontinuity. The thicknesses of the successive layers at NTS are given; the total crustal thickness is 34 km. The successive crustal layers at Ludlow have a thickness of H_0 = 1.4 km, H_1 = 13 km, and H_2 = 13 km; the total crustal thickness is 27 km.

GIBSON, B. D., Seismic Noise Survey - Vol. 4, Long-Range Seismic Measurements Program, Sci. Rept., Rept. No. TR 69-42, Contract VT/8703, F33657-69C-0757, Geotech-Teledyne Indust., Garland, Texas, 1969

VESIAC 19,882 VU
AD 860 602

This report is the fourth in a series of studies which evaluate seismic noise levels at LRSM sites. Data from the short-period and long-period vertical seismographs from 20 field sites are reviewed, and standardized data compilation methods are discussed. Cumulative probability distribution of amplitude curves, noise spectrum curves, and spectrum histograms are developed for each site studied.

GIESE, P., "Velocity Distribution in the Uppermost Region of Crystalline Rock Derived from Refraction Observations on the Bohmischbruck-Eschenlohe Profile," Zeitschrift Fur Geophysik 29, No. 5, pp. 197-213, 1963, (Translated from German). Contract SD-78.

VESIAC 7106 VU

On the refraction profile of Bohmischbruck-Eschenlohe, the first 25 km of the profile line are found on the crystalline rocks of the Bohemian massif. In the travel time diagram, the first arrivals are not in a straight line, but on a weakly curved one, which is the result of a velocity gradient. With approximate integration, the velocity course with depth can be calculated. The result is compared with those of other measurements. Velocity measurements conducted by Birch with increasing pressures and temperatures also result in a continuous increase in velocity. Further, it is possible to show a relation between the profile length and the measured velocity in the basement. A velocity gradient can explain discrepancies in velocity measurements on long and short profiles.

GILBERT, F., and G. E. BACKUS, Matrix Operations in Elastic Wave and Vibration Problems - Part III, Contract AF 49(638)-1388, Univ. of Calif., San Diego, Calif., 1965.

VESIAC 11,827-C VU

The boundary value problems most frequently encountered in studies of elastтc wave propagation in stratified media can be formulated in terms of a finite number of first-order ordinary differential equations with variable coefficients. Volterra (1887) has shown that solutions to such a system of equations are conveniently represented by the multiplicative integral or matricant of the matrix of coefficients. In this paper, the authors summarize some of the better known properties of matricants plus numerical methods for their computation. It is shown how one of the major sources of loss of numerical accuracy is eliminated.

GILBERT, F., and D. HELMBERGER, Low Frequency Discriminants for Small Events, Sci. Final Rept., Contract F44620-69C-0118, Univ. of Calif., La Jolla, Calif., 1970

VESIAC 20,420 VU

The Cagniard-deHoop method in generalized ray theory is extended to spherically layered media. The theory is approximate and is asymptotic tn reciprocal fractional powers of the frequency. For mantle body wave phases it is estimated that the theory can be used for P pulses with periods less than 40^s and S pulses with periods less than 75^s. An initial application of the theory to the study of LRSM recordings of NTS events shows: 1) models derived from travel time data alone may have synthetic seismograms that disagree with observations; 2) the structure of the upper mantle beneath North America has very significant lateral variations in the uppermost 700 km.

GILE, W. W., Research in Seismic Phenomena Connected with Earthquakes and Explosions, A Mercury Pendulum Seismometer - Sci. Rept., Contract F44620-69C-0067, Calif. Inst. of Tech., Pasadena, Calif., 1969

VESIAC 19,667 VU

A long-period mercury pendulum seismometer has been developed at the Seismological Laboratory, California Institute of Technology. The devices are presently operational in several locations throughout the world. The instruments exhibit extremely good sensitivity, stability, and signal-to-noise ratios in the .02 - .001 Hz range. Seismic waves of 3×10^{-4} Hz and tilts of a few parts in 10^{-11} radians have been observed.

GIRARD, B. W., R. H. KIRKLIN, and J. R. SHERWIN, Multicomponent Strain Seismograph, Quarterly Rept. No. 6, Oct. - Dec. 1966, Rept. No. TR-67-2, Contract VT/5081, AF 33(657)-15288, Teledyne Industries, Geotech Division, Garland, Texas, 1967.

VESIAC 15,536 VU
AD 807 662

Phase responses of the strain seismographs indicate appreciable deviations from theory. However, good cancellation of Rayleigh waves with combinations of strain and inertial seismographs indicates acceptable phase match. Unpredicted phase discrepancies of approximately 5 degrees in the 0.8 cps galvanometers of the strain seismographs can be eliminated by a simple conversion to a 3 cps system. Uncertainties in the phase response of the calibrators on the strain seismometers can be resolved by installing a monitor at the calibrator.

The main effort on the program has been shifted toward evaluating the directional capabilities of the strain-inertial combinations in the L-P spectrum. Design of instrumentation to implement this is discussed.

GIRARD, B. W., R. H. KIRKLIN, J. R. SHERWIN, and R. C. SHOPLAND, Multicomponent Strain Seismograph, Quarterly Rept. No. 7, 1 Jan. Through 31 March 1967, Project VT/5081, Contract AF 33(657)-15288, Teledyne Industries, Inc., Geotech Div., Garland, Texas, 1967.

VESIAC 16,068 VU
AD 814 641

Eleven seismograph channels at WMO were converted to a 3-cycle system, resulting in a significant improvement in matching of phase response of strain-inertial combinations. A substantial increase in utility of the S-P strain directional array data was achieved by a transition from offline summing to online summing of strain and inertial signals.

A combination of L-P horizontal strain and inertial seismographs with matched frequency responses was put into operation to evaluate its directional capabilities. Magnifications of 50K-100K are required to reject long-period microseisms effectively.

A comparison of the steel-cased borehole and the plastic-cased borehole indicates that 6-second microseisms are recorded with approximately 30 percent less amplitude in the steel-cased borehole.

GIRARD, B. W., R. H. KIRKLAND, J. R. SHERWIN, and R. C. SHOPLAND, Multicomponent Strain Seismograph, Quarterly Report No. 8, Contract VT/5081, AF 33(657)-15288, Teledyne Indust., Inc., Geotech Div., Garland, Texas, 1967.

VESIAC 16,735 VU

Use of an electromagnetic calibrator in place of the magnetostrictive calibrator on the vertical strain seismometer has eliminated phase discrepancies. Results show that all strain and inertial systems are matched within 4 degrees between 0.1 and 3 cps and within 10 degrees out to 10 cps. An analysis of coherency, phase, and spectra of seismic noise and signals computed by a fast transform program shows that the instruments are operating according to theory. The effects of temperature changes and wind on operation of the horizontal strain seismometers are discussed. Operation of a matched LP horizontal strain-inertial combination for directional discrimination of long-period surface waves is also discussed.

GLOTOV, O. K., "Consideration of Refraction on Intermediate Boundaries in Interpreting the Hodographs of Refracted and Reflected Waves," Prikladnaya Geol., No. 16, pp. 114-129, 1957, (Translated from Russian), Contract SD-78.

VESIAC 11,978 VU

These equations for applying a correction for the effect of refraction on intermediate boundaries with the graphs make it possible to reduce a multilayered medium to a 2-layered medium relatively rapidly. The problem is solved more simply and more accurately for the hodographs of refracted waves and it requires approximate solutions for the hodographs of reflected waves. At the same time, these formulas and graphs give the errors values, which are useful in evaluating the accuracy of survey work in regions where the effect of refractions has not been taken into account previously. The solutions are of practical importance primarily for platform regions characterized by gentle profiles of low amplitude, variable thickness of low velocity zone, and a high velocity in the supporting medium.

GLOVER, P. and S. S. ALEXANDER, A Comparison of the Lake Superior and Nevada Test Site Source Regions - Sci. Rept., Rept. No. 243, Contract VT/9706, F33657-69C-0913, Teledyne Indust., Inc., Alexandria, Va., 1970

VESIAC 20,081 VU

Two particular source regions, Lake Superior and the Nevada Test Site are documented in detail using available geological and geophysical observations. Each is discussed individually in relation to its setting in the prevailing regional crust and upper mantle structure of the mid-continent and the Basin and Range respectively. Comparison of the two source areas indicates that they are markedly different from one another not only at shallow depths but throughout the upper mantle as well. Location accuracies for events at both sites are quite comparable, however, a large bibliography documents the extensive literature relevant to Lake Superior and the Nevada Test Sites.

GLOVER, P., and S. S. ALEXANDER, A Preliminary Evaluation of the Matched Filter Technique in the Detection of Long-Period Body Wave Radiation, Sci. Rept., Rept. No. 222, Contract VT 6702, F33657-68C-0945, Teledyne Indust., Inc., Alexandria, Va., 1968

VESIAC 19,038 VU
AD 840 712

Using nine elements of the Montana LASA, long-period body wave radiation was detected at S/N ratios as low as 1 for synthetic test cases. In these instances beamforming the 9 matched filter outputs improved the S/N ratio by a factor of 2 over straightforward phased summation of the raw data. For real data, the results are less satisfactory.

GOGOLADZE, V. G., "Natural Vibrations in an Elastic Layer on a Rigid Base," Trudy Seismol. Inst., No. 119, pp. 39-45, 1947, (Translated from Russian), Contract SD-78.

VESIAC 12,358 VU

The natural vibrations in a plane parallel layer the base of which is rigidly connected with an elastic half space are discussed. The layer and the half space have arbitrary values of elastic constants and densities.

GOGOLADZE, V. G., "Rayleigh Waves at the Boundary of a Compressible Fluid and a Solid Elastic Half Space," Trudy Seismolog. Inst., No. 127, pp. 26-32, 1948, (Translated from Russian), Contract SD-78.

VESIAC 12,334 VU

The problem of the propagation of Rayleigh waves is studied at the boundary of a compressible fluid medium and a solid elastic half space. In contrast to the contact of various solid elastic media where Rayleigh waves cannot arise, the generation of Rayleigh waves is shown for an arbitrary contact of a fluid and a solid elastic medium along a plane.

GOGUEL, J., "Tectonic Data in the Study of the Upper Mantle," ICSU Review of World Science, Vol. 6, No. 2, pp. 116-120, April 1964, (Translated from French),Contract DA 49-083 OSA-3137.

VESIAC 14,150 VU

The author's purpose is to formulate a rapid inventory of data that can be supplied by tectonics and which will have to be taken into consideration by any hypothesis of the upper mantle. First, it is necessary to make a choice among tectonic data to eliminate the superficial aspect of deformation and expose the deep causes. A number of kinds of compressional motion are considered. Movements of elongation may constitute a normal counterpart of compression. The author considers a third type of index of motion the large strike slip faults. The importance of the reconstruction of the chronology of crustal motions, the chronology of tectonic movements in general and other matters are considered.

GOL'DIN, S. V.,"On Distribution of Probabilities for the Interval Between Neighbouring Extrema of Two Strongly Correlated Random Functions," Geol. i. Geofiz., No. 6, pp. 19-34, 1964, (Translated from Russian), Contract SD-78.

VESIAC 12,445 VU

An examination is made of the problem that arises in connection with estimating the probabilities for the relative displacement of the extremals of two strongly correlated random functions.

In the solution of many geophysical problems the question arises of the probability distribution for the interval between adjacent extremals of two random functions which are correlated: in the phase correlation of seismograms, in tracing the axes of magnetic and gravity anomalies, in estimating the displacement of the anticlines of uplifts caused by errors in depth, etc. In the present report this question is examined in a general form for the case of two stationary highly correlated Gaussian functions.

GOL'DIN, S. V., "Probability of False Events on Seismic Records," Geol. & Geofiz., No. 1, pp. 73-91, 1965, (Translated from Russian), Contract SD-78.

VESIAC 12,553 VU

The article examines the probability of erroneous detection and erroneous absence of waves in the case of an amplitude criterion for the detection of seismic pulses, applied in the visual correlation of seismograms and summary tapes. The problem of the selection of the optimum parameters of the criterion is examined. The influence of interference systems is estimated.

GOL'DIN, S. V., "On Utilization of Amplitude Correlations for Phase Correlation of Seismic Waves," Geol. I Geofiz., No. 5, pp. 65-79 1965, (Translated from Russian), Contract SD-78.

VESIAC 13,310 VU

The probability of amplitude inversion is reviewed in the first section; in the second section, the concept of inversion is generalized for the axis of synchronous phases as a whole. It is found that amplitude correlations between these axes and the corresponding inversions can be determined in a non-unique manner. Correlations obtained are used for the determination of probabilities of various variants of correlation.

GOLTSMAN, F. M., and T. B. KALININA, "Simplified Methods of Frequency Analysis and Synthesis and Their Application to the Solution of Certain Geophysical Problems," Akad. Nauk, Prikladnaya Geof., No. 21, pp. 3-25, 1958, (Translated from Russian), Contract SD-78.

VESIAC 11,447 VU

Methods of frequency analysis and synthesis are very widely used in various fields of physics and geophysics. Since the majority of the existing methods of analysis and synthesis involve cumbersome calculations or require complicated and expensive instrumentation, the development of simple approximate methods that can be performed on low quality computers is an urgent problem.

In this paper there are described methods for one type of harmonic analysis and synthesis of both non-periodic and periodic signals.

GOLTSMAN, F. M., and YU. I. LIMBAKH, "An Instrument for Frequency Analysis and Synthesis of Transient Signals," Akad. Nauk. Prikladnaya Geof., Vol. 21, pp. 26-36, 1958, (Translated from Russian), Contract SD-78.

VESIAC 11,417 VU

The theory of the methods of analysis and synthesis employed is discussed in detail in a separate paper, reference to which is made in this paper. Here are given only the major theoretical results necessary for describing the circuitry and the operation of the instrument. Theoretical considerations are presented, and then a description of the circuits and design of the instrument, followed by a section on operation of the instrument, and finally a section containing examples of the analysis and synthesis of certain signals.

GOODMAN, N. R., Eigenvalues and Eigenvectors of Spectral Density Matrices, Sci. Rept., Project VT/6702, Contract F 33657-67-C-1313, Teledyne Industries, Inc., Earth Sci. Div., Alexandria, Va., 1967.

VESIAC 16,079 VU
AD 814 687

This report describes some interpretations and uses of eigenvalues and eigenvectors of spectral and sample spectral density matrices of multiple stationary time series.

GORDON, D. W., Libyan Earthquake of February 21, 1963, Contract No. Project 7.3, U. S. Coast and Geodetic Survey, Washington, D. C., 1964.

VESIAC 8387 VU
AD 603 695

This report covers the Libyan earthquake of February 21, 1963, and the five teleseismically reported aftershocks. Its purpose was to contribute to the basic data concerning earthquakes and to examine possible differences between seismic waves excited by earthquakes, and those by explosions. The earthquake is discussed under these headings: 1) instrumentation; 2) WWSS data; 3) magnitude calculations; 4) comparison of earthquake and explosion seismograms; 5) epicenter calculations; and 6) depth considerations. A summary states: 1) the Libyan earthquake was not particularly severe; 2) its magnitude was 5.3; and 3) extensive damage was caused by shallow focal depths, alluvium under Barce, loose building construction.

GORSHKOV, G. S., "A Catalog of the Active Volcanoes of the Kurile Islands Volcanoes of the Northern Islands," Akad. Nauk., Bull. of Volcanological Stations, No. 25, pp. 96-178, 1964, (Translated from Russian), Contract SD-78.

VESIAC 8975 VU

Active volcanoes of the Kurile Islands - 39 of them - are catalogued. The following information is given about each of them: a) Synonyms or other names for the volcano; b) Location; c) Height; d) Form; e) Geological characteristics; f) Tectonics; g) Structure; h) Age; i) Crater (discussion of its characteristics); j) Streams of lava - composition of the lava, and history of lava deposits; k) Composition of volcanic products; 1) Mineralogical composition; m) Pyroclastic products; n) Mineralogical composition of slag; o) Fumarole minerals; p) Gases; q) Dates of eruptions; r) Type of Eruptions; s) Peculiarities of volcanic activity; t) Indications of eruptions; u) Bibliography (of works cited at the back of this study - relevant references).

GRAY, G. A., Array Study, Tech. Rept. No. 64-122, Project VT/036, Contract AF 33(657)-12007, The Geotech. Corp., Garland, Texas, 1964.

VESIAC 8967 VU
AD 452 841

Filtering was used to simulate the effect of 10 different seismograph response characteristics on several teleseismic P-wave signals. The signals used were recorded with large signal-to-noise ratio on the short-period seismographs at the Wichita Mountains Seismological Observatory (WMSO). The amplitude of the first half cycle of each signal (first motion amplitude), relative to the maximum signal amplitude generally decreased with decrease in bandwidth. If the magnifications of the simulated seismographs were equalized at the period of the predominant microseisms (6-sec period), the first motion amplitudes generally increased as bandwidth decreased because of the resulting increase in magnification at shorter periods.

GRAY, G. A., Laboratory and Field Evaluation of the Willmore Mark II Seismometer, Contract VT/036, AF 33(657)-12007, Geotechnical Corp., Garland, Texas, 1964.

VESIAC 7546 VU

Shake table tests were conducted on a Willmore Mark II seismometer at The Geotechnical Corporation laboratory in Garland, Texas. Field evaluation tests were performed at the Wichita Mountains Seismological Observatory. The report summarizes the results of these tests.

GRAY, G. A., Operational Evaluation of Broadband Seismographs, VESIAC Rept. No. 4410-77-X, Contr. No. SD-78, Univ. of Michigan, Inst. of Sci. & Tech., Ann Arbor, Mich., 1964.

VESIAC 8865C VU
AD 452 161

Described is the broadband three-component seismograph at the Wichita Mts. Seism. Observ. (WMO), which was designed in accordance with recommendations of the Geneva Conference of Experts. Preliminary evaluation of detection capability indicated that the broadband system added very little to the total seismic de ection capability of WMO. Examples are given of this conclusion. The identification of earthquake phases, especially for large regional earthquakes, seemed to be the only area in which the broadband visual presentation was often superior to the other systems. The broadband vertical seismograph was also operated at a higher speed for several months to further evaluate its detection capabilities.

GRECHNISHNIKOV, G., and V. NOMOKONOV, "Features of Refracted Waves Generated in a Medium Containing a Vertical Layer (According to Modeling data)," Vyssh. Ucheb. Zavedeniy Izv., Geologiya i Razved., No. 2, pp. 116-123, 1965, (Translated from Russian), Contract DA 49-083 OSA-3137.

VESIAC 13,657 VU

The authors' investigations were oriented toward the study of solid models in the case of a practicaliy infinite vertical thickness of the lower refracting media. Results are presented for plane and curved surfaces of a lower refracting medium containing a vertical bed of lower velocity. Apparatus and procedure, the method of observations, features of plane boundary, vertical bed, and kinematic and dynamic features are discussed.

GREEN, P. E., Effect of Using Subarrays on the Directivity Pattern of the Extended TFO Array, Contract AF 19(604)-7378, Lincoln Labs., M. I. T., Lexington, Mass., 1964 (OFFICIAL USE ONLY).

VESIAC 7745 VU O

GREEN, P. E., A Large Aperture Seismic Array, Group Rept. 1965-1, Contract AF 19(628)-500, Mass. Inst. of Tech., Cambridge, Mass., 1965.

VESIAC 9286 VU
AD 609 851

The Large Aperture Seismic Array is an experimental system designed to provide improved capability for seismic discrimination of nuclear explosions and earthquakes. This improvement is to be brought about by suppression of reverberation and microseismic noise relative to the signal through the use of a larger number of sensors and a larger array aperture than previously employed in seismic arrays for this purpose. This report gives a brief sketch of the way in which the signal improvement is to be achieved, followed by a short physical description of the various parts of the entire array design as it is currently envisioned, including the choice of sensors, array geometry, signal telemetry, and signal processing.

GREEN, P. E., Seismic Data Collection, Sci. Rept., Rept. No. ESD-TR-67-510, Contract AF 19(628)-5167, Lincoln Labs., Mass Inst. of Tech., Lexington, Mass., 1966

VESIAC 19,030 VU
AD 661 154

Modern techniques of sensing, transmitting and automatically analyzing seismometer outputs are discussed, using the experimental Large Aperture Seismic Array as an example.

GREEN, P. E., Seismic Discrimination, Semiannual Tech. Summ., Contract No. AF 19(628)-500, Mass. Inst. of Tech., Lincoln Labs., Lexington, Mass., 1964.

VESIAC 8364 VU
AD 443 444

This is the first semiannual report of the Lincoln Laboratory's work on seismic discrimination (VELA UNIFORM). These subjects are discussed: 1) the approach to be used; 2) the signals of primary interest; 3) the distance figure and the magnitude figure. The conclusion was reached that arrays of seismometers offer the best possibilities for significant improvement. Thus, the current program is heavily oriented toward planning for future arrays that are very large horizontally, possibly involving three-component sensors. A summary of the work done during the period under review is discussed. Also, the results of signal analyses in progress are described. Work is being done on the application of communication theory ideas to arrays.

GREEN, P. E., Seismic Discrimination, Semiannual Tech. Summ. Rept., Rept. No. TDR-65-597, Contract AF 19(628)-5167, Lincoln Lab., MIT, Lexington, Mass., 1965.

VESIAC 14,231 VU
AD 630 559

The experimental LASA in Montana is now operational and has been used for routine monitoring and data recording. Most of the physical elements of the system are working more reliably than had been anticipated. Research and experimentation with various array processing techniques are described, and results on automatic event detection and location are discussed. As a result, LASA capabilities soon can be established, the signal processing hardware design can be made final, and a design of a possible global network of these stations can be worked out, if needed.

Results of nuclear test monitoring and research on the solid earth with the signal improvement system are described. Two studies of seismic instrumentation are also reported.

VESIAC 14,828 VU
AD 637 308

GREEN, P. E., Seismic Discrimination, Semiannual Tech. Summ. Rept., 1 January to 30 June 1966, Rept. No. ESD-TR-66-250, Contract AF 19(628)-5167, Lincoln Lab., Mass. Inst. Tech., Lexington, Mass., 1966.

The capabilities of the experimental LASA to detect, reprocess, and identify teleseismic signals have been evaluated. The detailed results are summarized, and current performance of the physical elements of the system is discussed. Exploratory work on the following topics is described: a different method of measuring P-complexity, a novel scheme for wideband seismometer calibration, processing of signals from a set of three-component seismometers, and a computer simulation of the LASA seismometer channel.

VESIAC 15,534 VU
AD 646 677

GREEN, P. E., Seismic Discrimination, Semiannual Tech. Summ. Rept., July - Dec. 1966, Rept. No. ESD-TR-67-18, Contract AF 19(628)-5167, Mass. Inst. Tech., Lincoln Lab., Lexington, Mass., 1966.

Studies have continued of the ability of a single Large Aperture Seismic Array (LASA) station to detect and roughly locate teleseismic events and to generate outputs derived from various long- and short-period seismogram parameters, particularly those related to exact epicenter location and source discrimination. The behavior of networks that exchange such data and that consist of both small and large array stations has begun to receive attention. Computer-controlled automatic monitoring and maintenance of large seismometer arrays are discussed.

VESIAC 17,131 VU
AD 657 327

GREEN, P. E., Seismic Discrimination, Semiannual Tech. Summ. Rept., 1 January Through 30 June 1967, Contract AF 19(628)-5167, Lincoln Lab. - MIT, Lexington, Mass., 1967.

In continuation of work on networks embodying both large and small arrays, plans have been prepared for a second LASA station. Studies of on-line detection and location and also signal-to-noise improvement using large array structures are continuing. Significant progress in the discrimination area using relative excitation of body and surface waves is reported.

VESIAC 17,433 VU
AD 664 872

GREEN, P. E., Seismic Discrimination, Semiannual Tech. Summ. Rept., 1 July to 31 December 1967, Rept. No. ESD-TR-67-597, Contract AF 19(628)-5167, Lincoln Labs., Mass. Inst. of Tech., Lexington, Mass., 1967.

Seismic source identification studies have continued during the present reporting period, using a single large array (the Montana LASA), while initial construction, design, and seismic surveying have proceeded for a possible second large array in Norway to work jointly with the LASA and other stations. Work on improving the convenience of machine seismic signal processing is reported, as well as research on earth structure, microseismic noise, and the measurement of long-baseline earth strain using laser interferometers.

VESIAC 16,745 VU

GREEN, P. E., Seismic Discrimination, Semiannual Tech. Summ. Rept., Contract AF 19(628)-5167, Lincoln Labs., Mass. Inst. of Tech., Cambridge, Mass., 1967.

In continuation of work on networks embodying both large and small arrays, plans have been prepared for a second LASA station. Studies of on-line detection and location and also signal-to-noise improvement using large array structures are continuing. Significant progress in the discrimination area using relative excitation of body and surface waves is reported.

VESIAC 18,661 VU
AD 673 354

GREEN, P. E., Seismic Discrimination, Semiannual Tech. Summ. Rept., 1 January to 30 June 1968, Rept. No. ESD-TR-68-199, Contract AF 19(628)-5167, Mass. Inst. of Tech., Lincoln Labs., Lexington, Mass., 1968.

Seismic source identification work during this reporting period has involved the development of several new analysis techniques for almost completely automatic production measurement on seismograms, and for less routine, more detailed studies. Studies of array signal detectability and signal and noise spatial character continue using data from both Montana LASA and Norway NORSAR.

VESIAC 19,311 VU
AD 682 297

GREEN, P. E., Seismic Discrimination, Semiannual Tech. Summ. Rept., 1 July to 31 December 1968, Rept. No. ESD-TR-68-369, Contract AF 19(628)-5167, Lincoln Labs., M. I. T., Lexington, Mass., 1968.

Seismic source identification work during this reporting period has emphasized improving the ability of short-period discriminants to work at lower magnitudes, and the use of a wider variety of stations, including especially the NORSAR site in Scandinavia. During this period, plans to upgrade our signal analysis capability and at the same time move into closer proximity to the academic part of M. I. T. have reached partial fruition.

VESIAC 19,809 VU
AD 691 434

GREEN, P. E., Seismic Discrimination, Semiannual Tech. Summ. Rept., 1 January to 30 June 1969, Rept. No. ESD-TR-69-159, Contract AF 19(628)-5167, Lincoln Labs., M. I. T., Lexington, Mass., 1969.

Seismic source identification work during this reporting period has emphasized continued studies of short-period discriminants, in particular, the physical sources of some of the spectral effects observed, attempts to exploit arrays of several thousand kilometers' aperture, and a probabilistic model of the two currently most promising discriminants.

VESIAC 17,619 VU
AD 828 319

GREEN, P. E., R. J. GREENFIELD, Application of Large Aperture Array Techniques to Tsunami Warning - Tech. Note, Rept. No. TN-1967-58, Contract AF 19(628)-5167, Lincoln Labs., Mass. Inst. of Tech., Lexington, Mass., 1967.

A brief examination is made of the potentialities of a single large array like the Montana LASA in providing rapid tsunami warning information from earthquakes at teleseismic distances from the array. It appears that speed and location accuracy of such a station are adequate.

Depth determination from depth phase observation is somewhat enhanced compared to that available from a small station, but the reliability of depth determination by the combined use of depth phases, body-surface magnitude differences, and surface wave dominant period is still not as reliable as required. The empirically observed limit on tsunami magnitude imposed by water depth is explained.

GREEN, P. E., E. J. KELLY, J. CAPON, and R. T. LACOSS, Large Array Seismology, Sci. Rept., Contract: Agency Document, Mass. Inst. of Tech., Lincoln Labs., Lexington, Mass., 1969

VESIAC 19,302 VU

This paper describes the contributions that have originated in the last three years from the processing of data gathered by the many seismometers of the Large Aperture Seismic Array.

From the purely scientific point of view, perhaps the most interesting results are those concerned with earth structure and the detailed spatial decomposition of the microseismic noise field. From the functional point of view, the improved ability to discriminate explosions and earthquakes is the important result. And last of all, there have been several contributions to applied information theory in the development of techniques for processing multiple time series and for analyzing the resulting parameter measurements.

GREEN, P. E., JR., R. V. WOOD, JR., Large Aperture Seismic Array Capabilities, Tech. Rept. No. 421, Rept. No. ESD-TR-66-361, Contract AF 19(628)-5167, Lincoln Lab., Mass. Inst. Tech., Lexington, Mass., 1966.

VESIAC 14,978 VU
AD 639 197

Presented are the results of a study of the experimental LASA in Montana. An attempt has been made to draw conclusions from the study of this station about the performance that might be expected from a worldwide net of them. The report discusses reliability and continuity of observations from a LASA system, threshold levels for automatic detection and location of weak events, various S/N enhancement processes available for on-line and off-line use, and the effect of such enhancements on the ability to discriminate source types. A system of high reliability seems to be the result. Accuracy of the detection threshold, off-line processing gains in SNR and improvement in ability to see waveform figures, are discussed.

GREEN, R. W. E., A. L. HALES, Travel Times in the Central United States for Project EARLY RISE (Abstract), Contract AF 49(638)-1746, Southwest Center for Advanced Studies, Dallas, Texas, 1967

VESIAC 15,716 VU

During Project EARLY RISE seismic observations were made along two profiles (1) from Lake Superior through Topeka, Wichita and San Angelo to the Texas-Mexico border, and (2) from Lake Superior through Dubuque and Little Rock to the Arkansas-Louisiana border. In addition travel times were observed along an arc at a radius of about 1250 km from the shot point from West Virginia to the Kansas-Nebraska border. P travel times along the two profiles were the same within the observational error. The apparent velocity was 8.15 km/sec for distances between 280 and 700 km.

From 700 km to 2200 km the times are in general within half a second of a line with apparent velocity 8.47 km/sec. Calculations show that the travel times can be fitted reasonably well by a model in which the velocity below Moho is 8.02 km/sec. The velocity rises to 8.16 km/sec at a depth of about 90 km, increases to 8.28 km/sec at that depth, and then to 8.40 km/sec at 250 km. However, there is some indication of a break in travel time at 1500 km, and amplitudes fall fairly sharply beyond that point suggesting that the structure is in fact more complex. Model calculations will be presented illustrating the range of interpretation which is consistent with the data.

GREEN, R. W. E., and A. L. HALES, Travel Times from Lake Superior Shots, 1966, Interim Tech. Rept. No. 2, Project EARLY RISE, Contract AF 49(638)-1746, Southwest Center for Advanced Studies, Dallas, Texas, 1967.

VESIAC 15,735 VU

Amplitudes of Early Rise arrivals have been reread. The mean amplitudes for each station are shown in tabular and graphic form.

GREENSFELDER, R. W., The Problem of Determining Depth of Focus with Applications to Nevada Earthquakes, GRANT AF-AFOSR-646-64 (AFOSR), Univ. of Nevada, Reno, Nev., 1964.

VESIAC 9607 VU

The basic principles of hypocenter location are discussed, with special attention to the determination of depth of focus, and to factors and conditions controlling error. The P_g-P_n method is theoretically developed and then applied to Nevada earthquakes, and it is found that, as expected, the method is dependent on the crustal model used. The appearance of large errors in depths of focus calculated for some Nevada earthquakes leads to the conclusion of a major discontinuity in crustal thickness (ca. 10 km) north and east of Walker Lake, Nevada. This discontinuity may have its surface expression in the Walker Lane, a major right-lateral shear zone. This zone has been defined on both physiographic and geologic grounds.

GREENFIELD, R. J. and R. M. SHEPPARD, The Moho Depth Variations Under the LASA and Their Effect on $dT/d\Delta$ Measurements, Sci. Rept., Contract: Agency Document, Mass. Inst. of Tech., Lincoln Labs., Lexington, Mass., 1968

VESIAC 18,659 VU

The LASA array in Montana was used to measure the slope of the travel time curve for events with epicenters to the northeast and southeast. Lateral inhomogeneities under the array introduce large relative arrival time errors (station residuals). A model for the crust under LASA is proposed which can explain the station residuals. This crustal model accounts for the major differences between the measured and Jeffreys-Bullen values.

GREGSON, V. G., T. J. AHRENS and C. F. PETERSEN, Dynamic Properties of Rocks, Final Rept., Contract No. AF 19(604)-8419, Stanford Res. Inst., Menlo Park, Calif., 1963.

VESIAC 6050 VU
AD 413 819

Hugoniot equation of state data in the pressure range 5 to 250 kb have been obtained for quartzite, sandstone, calcite, marble, limestone, plagioclase, and basalt. The data were obtained by conventional shock wave techniques which measure shock and associated free-surface velocities. Impedance match solutions were obtained for porous rocks. Given are the high values of the Hugoniot elastic limit that were observed in solid rocks. Porous rocks show considerably reduced values amounting to approximately 5 kb in sandstone and limestone. Four phase transitions, indicated by multiple shock fronts, are observed in calcite. No simple relation between these and the reported transitions observed in static experiments is evident.

GRIFFIN, J. N., Applications and Development of Polarization (Remode) Filters, Rept. No. SDL Rept. 141, Contract VT/6702, AF 33(657)-15919, Teledyne Industries, UED, Alexandria, Va., 1966.

VESIAC 14,174 VU
AD 630 515

Polarization filters of the REMODE class are described. Also described are filters having low, intermediate, and high selectivity in detecting rectilinear motion which has a specified direction and degree of polarization.

Two digital filters of intermediate selectivity are demonstrated as aids in the detection and identification of depth phases in the highly polarized coda of teleseismic P phases. One is normalized, the other is un-normalized.

GRIFFIN, J. N., Field Study of Variation in Characteristics of Seismic Noise and Signals with Geologic and Geographic Environment, Semi-annual Rept., UED Rept. No. AAD 62-39, VT/078, Contract AF 33(600)-42048, United ElectroDynamics, Inc., Pasadena, Calif., 1962.

VESIAC 9571 VU
AD 462 159

Project VT/078 recording of seismic signal and noise for correlation with geologic and geographic environment has been completed in California, and continues in the Appalachian Mountains. After tabulation of all noise and environmental data for California Stations, a system of linear equations was set up relating noise levels of 1.25 - 1.50 sec period to environment. Solution of these equations hopefully will yield an array of coefficients showing noise level changes caused by a unit change in each environmental variable. Findings concerning noise amplitude correlations, noise source directions in the Pacific Northwest, and the period noise observed at inland Pacific Northwest stations are given.

GRIFFIN, J. N., REMODE Signal/Noise Tests in Polarized Noise, Sci. Rept. No. 162, Contract VT/6702, AF 33(657)-15919, Teledyne Industries, Inc., Earth Sciences Div., Alexandria, Va., 1966.

VESIAC 14,979 VU
AD 800 364

A rectilinear motion detector has been developed which has controllable sensitivity to the phase and direction of ground motion. Input-output SNR tests were conducted on the detector, using as test data a P phase which had been inserted into signal-generated noise at several values of SNR. In noise which was polarized in a different direction from the signal, the detectors with high directional sensitivity provided large SNR gains at high input SNR levels. Gain decreased rapidly as input SNR levels fell to 0 db and lower. In noise polarized in the same direction as signal, SNR gain was low.

GRIFFIN, S. F., and J. MASSE, Short-Period Deep-Hole Triaxial Seismometer, Tech. Rept. No. 64-126, Project VT/072, Contract AF 33(657)-9967, The Geotech. Corp., Garland, Texas, 1964.

VESIAC 8970 VU
AD 452 842

A short-period deep-hole triaxial seismometer has been built. The instrument consists of three identical modules stacked inside of a 5-in. diam. case and rotated 120 deg. with respect to each other. The natural frequency of each module is 1 cps, the maximum operating depth is 10,000 ft with an internal resistance of 400 ohms, and each inertial mass is 13 kg. A seven-conductor cable and a stepping switch inside the case permit remote operation of electromagnetic calibrators, mass position motors and indicators, and a hole lock.

GRIFFIN, S. F. and J. C. MOORE, Improved Shake-Table System, Contract No. VT/072, AF 33(657)-9967, Geotechnical Corp., Garland, Texas, 1964.

VESIAC 8482 VU
AD 446 578

An improved shake-table system, which includes vertical and horizontal tables, was built, tested and calibrated. The system has an electrohydraulic drive that can be controlled by magnetic-tape playback. Therefore, seismographs can be tested with actual seismic signals. Large steel diaphragms in the suspension systems provide high spring rates and restraint against nonaxial motions. Motion monitors permit accurate determination of wave type, phase, and table amplitude. Displacements of the vertical and horizontal tables are calibrated with an error no greater than 1% by use of an optical-flats calibrator and a capacitance micrometer, respectively.

GRISSON, D., J. R. SHERWIN, and R. C. SHOPLAND, Development of LP Wave Discrimination Capability Using LP Strain Instruments, Quarterly Rept. No. 1, 1 July to 30 Sept. 1968, Rept. No. TR 68-44, Contract VT/8706, F33657-69C-0121, Teledyne Indust., Inc., Geotech Div., Garland, Texas, 1968

VESIAC 19,101 VU
AD 844 471

The design of strain seismographs capable of detecting long-period seismic motion is in progress. The moving coil-permanent magnet and the direct current-variable capacitance techniques appear to be the most promising and laboratory models of transducers using these techniques are being constructed for testing. Many mines in the Payson, Arizona, and the Las Cruces, New Mexico, area have been visited. Three mines meeting many of the requirements for instrument installation were located and could be used if necessary improvements are made.

GUDZIN, M. G., Evaluation of the Vertical Long-Period Seismometer, Sprengnether Model S-5100V, Special Evaluation Rept., Rept. No. TR 70-30, Contract VT/0704, F33657-70C-0733, Teledyne-Geotech, Garland, Texas, 1970

VESIAC 20,424 VU
AD 875 945

The Sprengnether Model S-5100V seismometer, equipped with both electromagnetic and capacitive transducers, was assembled and tested in the laboratory and in a vault. Data concerning its measured performance characteristics were collected and evaluated.

VESIAC 13,858-C VU
AD 648 415

GUDZIN, M. G., Progress Report on Long-Period Instrumentation for LASA, Contract: VT/4051, AF 33(657)-12145, Teledyne, Inc., Geotech. Div., Garland, Texas, 1965.

This is a report of the work undertaken to establish an LP detection and recording capability at LASA. It includes a description of the prototype installation, a description of the results of tests with the prototype equipment, a description of the work done with parametric amplifiers, a presentation of present plans for the LASA LP seismograph system, and a consideration of studies that might be undertaken using data acquired by the system.

VESIAC 5566 VU

GUDZIN, M. G., Wichita Mountains Seismological Observatory, Semiannual Rept. No. 1, Contract No. VT/036, AF 33(600)-41318, Geotechnical Corp., Garland, Texas, 1961.

This report summarizes work on the program connected with the Wichita Mountains Seismological Observatory from July 1 through December 31, 1960. Operation of the station started on October 1 and included an attempt to collect data from the SCOOTER shot of October 12 to 14. The short-period, narrow-band and broad-band instruments detected no signals from SCOOTER. The facility includes 21 seismometers for which operating parameters are tabulated. Tables contain the data recorded through December, the schedule for completion design and evaluation tasks, the distribution of equipment and the seismograph's response characteristics. Other work in progress, concerning calibration, data-handling and data-storage procedures, analysis procedures are described.

VESIAC 16,374 VU
AD 815 682

GUDZIN, M. G., F. M. HENNEN, LASA LP System, Final Rept., Rept. No. TR 67-17, Project VT/6701, Contract AF 33(657)-15190, Teledyne Co., Geotech, Garland, Texas, 1967.

During the time period from August 1965 to October 1966, a set of three-component long-period instrumentation was added to each subarray of the Montana LASA. The instrumentation, which provides analog signals to the existing data handling and telemetry system of the LASA, consists of three LP seismometers housed in an underground concrete vault and a three-channel, solid-state parametric amplifier located in the Central Telemetry Housing at each subarray. Equipment for interconnection of the instrumentation, lightning protection, and remote adjustments to the seismometers was installed. During the installation, each set of instrumentation was calibrated. This report briefly describes the instrumentation, the installation and calibration procedures, and the problems encountered during the installation of the LASA LP system.

VESIAC 6886 VU
AD 409 864

GUIDROZ, R. R., Surface Wave Attenuation, Spec. Rept. No. 7, Contract No. AF 19(604)-8517, Texas Inst., Dallas, Texas, 1963.

Studies were made to determine azimuthal and path dependence of surface wave amplitude using the data available in the program, for possible application to the problem of distinguishing earthquakes from explosions. The study showed that surface waves from blasts, like those from earthquakes, do not form circular radiation patterns about their points of origin. Change in relative surface wave amplitude is expected as a function of azimuth from earthquakes, but there is less clear reason why very much deviation from a circular pattern should be evident for nuclear blasts, as was the case with the limited data studied. Discussed is relation of anomalous amplitudes to surface wave travel paths and local geology. Also presented are results from explosion records.

GUIDROZ, R. R., World Wide Collection and Evaluation of Earthquake Data, Semiannual Tech. Rept. No. 5, Vol. I - Review of the Program, Contract No. AF 19(604)-8517, Texas Inst., Dallas, Texas, 1963.

VESIAC 7060 VU

This volume is the first in a series on "Worldwide Collection and Evaluation of Earthquake Data". The purpose of the overall program, and Texas Instruments' role in it are discussed. A review of current work in included. Details of the report are presented in the following sections: 1) review of 1963 studies; 2) review of 1960 studies; 3) review of reports; and 4) summary of findings. The studies presented here are mainly on seismicity evaluation, and fall into four major catagories: seismicity, noise, earthquake, and explosion studies. Other studies are included—focal mechanisms, azimuthal and path attenuation effects, wave or phase identification, phase velocities, etc. Gross worldwide assessmement or "calibration" is discussed.

GUIDROZ, R. R., Worldwide Collection and Evaluation of Earthquake Data, Semiannual Tech. Rept. No. V, Vol. II, Station Assessment, Con. No. AF 19(604)-8517, Texas Inst., Dallas, Texas, 1963.

VESIAC 7061 VU

This volume is the second in a series on "Worldwide Collection and Evaluation of Earthquake Data." The discussion here centers on capabilities of seismograph stations from which data were obtained. The report has two sections: 1) Section I describes the methods used in evaluating individual stations. Based on this evaluation (which included perceptibility, instrumentation, and personnel) 23 stations were selected for the best recording capabilities in 1960. 2) Section II contains a data sheet on each of the stations from which records were collected. Data on each sheet include description of the station's instrumentation, location, environment, and other pertinent factors.

GUIDROZ, R. R., Worldwide Collection and Evaluation of Earthquake Data, Semiannual Tech. Rept. No. V, Vol. III Noise Spectra, Contract No. AF 19(604)-8517, Texas Inst., Dallas, Texas, 1963.

VESIAC 7062 VU

This volume is the third in a series on "Worldwide Collection and Evaluation of Earthquake Data". A method for obtaining relative noise power density spectra from simple polarity information was developed by Texas Instruments, and reported on October 31, 1962, in Semiannual Technical Report No. III. Methods for obtaining absolute spectra and ground motion from relative spectra have subsequently been developed and are described here. Section I of this report deals with relative power density. Section II discusses in detail the means of obtaining absolute values from the relative spectra. In an Appendix, 205 relative noise power density spectra are presented. The means by which the data used for this computation was obtained is presented.

GUIDROZ, R. R., T. W. HARLEY, and D. G. EZELL, 30 Day Ocean-Bottom Seismograph Modification and Testing of Nineteen Ocean-Bottom Seismographs, Final Rept., Feb. - Nov. 1966, Contract AF 19(628)-5890, Texas Instruments, Inc., Dallas, Texas, 1966.

VESIAC 15,532 VU
AD 649 982

Dallas modifications and tests, Albuquerque land tests, shallow and deep water tests off the coast of California, and antenna tests were run to prove that the Ocean-Bottom Seismograph is a practicable seismograph. Dallas modifications included pressure switches added to the radio transmitter and the beacon light. A new high-precision motor was added to the tape recorder. Pressure transducer sensitivity was increased by approximately 20 db. The trigger board was redesigned for sonar recall. The U-joint, battery boxes, bottom and side plugs, and secondary release were also modified, and an input filter was added. Albuquerque land tests showed almost exact duplication between OBS data and that from adjacent reference seismometers.

GUIDROZ, R. R., T. HARLEY, and B. KIMLER, 30-Day Ocean-Bottom Seismograph, Shallow and Deep Water Tests, Final Rept., Supplement, Oct. 7, 1965 to February 1966, Contract AF 19(628)-4075, Texas Instruments, Inc., Dallas, Texas, 1966.

VESIAC 19,025 VU
AD 660 130

A shallow and deep-water test program was conducted to assess the system performance of 19 ocean-bottom seismograph units. The test results were evaluated for rate of recovery of units and operation of electrical and mechanical components.

GUIDROZ, R., F. R. HOWARD, and J. FREDERIC, Explosion Program - Kurile Islands Experiment, Spec. Rept. No. 2 - Ocean-Bottom Seismograph Experiments, Project VT/6708, Contract F33657-67C-0105, Texas Inst., Inc., Dallas, Texas, 1967.

VESIAC 17,028 VU
AD 661 288

This report details the procedures developed for the explosion program and gives the reliability of the calibration program. The explosive used was 120,000 lb of high-energy composition B packed in 50-lb cubical cans, which was shot in ten 5.2-ton, six 1-ton and one 1.5-ton packages. These charges were exploded in a network designed to provide optimum recording on the ocean-bottom instruments and minimum damage to marine life. The shots were restricted to the following conditions: daylight hours, 2 mi or more from any approaching vessel, a minimum of 13000 fm of water depth, and/or more than 100 km from land.

GUMPER, F. J., Research Directed Toward the Use of Long and Intermediate Period Seismic Waves for the Identification of Seismic Sources, Annual Tech. Rept. No. 1, 1 August 1968 to 1 August 1969, Contract F19628-68C-0341, Lamont-Doherty Geol. Observ., Columbia Univ., Palisades, N. Y., 1969

VESIAC 19,883 VU
AD 695 495

Seismological research supported by Air Force contract F19 (628)-68-C-0341 at the Lamont-Doherty Geological Observatory is summarized for the period 1 August 1968 to 1 August 1969. During this period significant advances have been made toward the use of long and intermediate period seismic waves for the identification of seismic sources. Our increased understanding of many features of the seismogram has enhanced its utility in detecting and identifying small seismic events. A large network of long and intermediate period instruments has been operated, and new high sensitivity, broad-band, low noise instruments have been developed which have proved especially effective for detecting and discriminating small events. Studies of seismicity and focal mechanisms for several tectonic regions and the attenuation of the Sn phase have provided additional support for the model of the New Global Tectonics. Study of the relative excitation of both body waves and surface waves by earthquakes and explosions have continued to reveal it to be a powerful discriminant between the two sources. The steady development of computer programs has permitted rapid and sophisticated analysis of both conventional and Large Aperture Seismic Array data. Thus, important progress has been made toward detecting and identifying seismic events.

GUNTHER, S., "Influence of the Atmospheric Pressure Changes on the Solid and Liquid Components of the Earth's Surface," Zeitschrift fur Physikalische Erdkunde, Vol. II, pp. 71-152, 1895. (Translated from German). Contract DA 49-083 OSA-3137.

VESIAC 14,782 VU

The author considers the problem of whether, and to what extent, variations in pressure in the lithosphere and the hydrosphere of the earth are caused by changes in atmospheric pressure. First, he studies whether a changing load of atmospheric pressure can cause differences in ground level which could be detected by improved equipment. Second, microseismic vibrations are considered, third, volcanic phenomena are studied. Next, the author considers water level variations of a longer period, and those which are rapidly equalized. Finally he considers atmospheric pressure in relation to mineral and fresh-water springs.

GUPTA, R. N. and G. H. MC TAGGART-COWAN, Crustal Seismic Refraction Profiles - A Compilation, Contr. No. AF 19(628)-222, Univ. of Toronto, Toronto, Canada, 1964.

VESIAC 8563 VU

This document is the first annual supplement to "The Crustal Seismic Refraction Profiles--A Compilation" by McConnel and McTaggart-Cowan (1963). Three maps are included which give, respectively, the profile location, velocity in the upper mantle, and the depths to the Moho Discontinuity as determined by the newly reported profiles in North America. An errata is attached which gives the correct version of the profiles which are in error in the original study.

GUREVICH, G. I., "The Dependence Between Stresses and Displacements in the Presence of Great Strains in the General Case of Three-Dimensional Loading," Trudy Inst. Fiziki Zemli, Akad. Nauk, SSSR, No. 2, pp. 27-59, 1959. (Translated from Russian). Contract DA 49-083 OSA-3137.

VESIAC 17,134 VU

It has been shown by a number of examples that if the exponential dependence of the relaxation time on the stressed state and temperature is taken into consideration in it, the well-known Maxwell relaxation equation in its main features characterizes the regularity of the strain common to bodies of different structure which are in any degree of a condensed ("solid-liquid") state.

However, as follows from the physical meaning of the Maxwell equation examined in the regularity described by that equation applies to the same degree to large as to small strains and can be mathematically expressed in a form whose applicability is not limited by the magnitude of the strains and shifts.

GUREVICH, G. I., "A Generalization of the Maxwell Equation for the Three-Dimensional Case with Consideration of Small Elastic Afterworking," Trudy Inst. Fiziki Zemli, Akad. Nauk, SSSR, No. 2, pp. 60-74, 1959, (Translated from Russian), Contract DA-49-083 OSA-3137.

VESIAC 16,507 VU

In this report, three-dimensional correlations between strains and stresses for bodies with and without elastic afterworking are derived.

GUREVICH, G. I., "On the Physical Principles of the Theory of Elastic Wave Propagation," Trudy Geofiz. Inst., A. N. SSSR, No. 30, pp. 314-348, Undated, (Translated from Russian), Contract DA-49-083 OSA-3137.

VESIAC 17,640 VU

On the basis of general concepts developed earlier concerning the mechanical properties of materials, a three-dimensional system of equations is derived for the propagation of elastic waves in a homogeneous medium which can be ideally elastic, liquid, or may be in any intermediate state. The equations are applicable for the case of small stresses (for example, in the case when one considers seismic vibrations not generated by powerful earthquakes and not in the immediate vicinity of the seismic focus). The laws of the attenuation of vibrations with high stresses are also discussed in their more general outlines. The relationship and the difference between the mechanical properties of materials under conditions of laboratory investigations (static tests) and under the conditions of seismic wave propagation are pointed out.

GUREVICH, G. I., and A. L. RABINOVICH, "The Dependence Between Stresses and Displacements in the Presence of Large Strains in the Case of a One-Dimensional Problem," Trudy Inst. Fiziki, Zemli, Akad. Nauk, SSSR, No. 2, pp. 3-25, 1959, (Translated from Russian), Contract DA-49-083 OSA-3137.

VESIAC 16,673 VU

This report presents a mathematical examination of large residual strains in an elastic body.

GURVICH, I. I., "Analysis of Reflections from Thin Layers," Prikladnaya Geof., No. 15, pp. 33-52, 1956, (Translated from Russian), Contract SD-78.

VESIAC 11,980 VU

The development of modern seismic surveys is related to the formulation of new methods of analysis of seismograms. The attempts toward a more complete use of the records of oscillations is well illustrated by the method of refracted waves which involved the use of several methods of processing materials based on the study of the record, including its amplitude characteristics. Equally important is the development of such in connection with reflected waves, with which one can get a more complete idea of the seismological profile record. Having already examined certain problems relaiing to the characteristics of reflection from thin layers, the authors here discuss the concrete possibilities of analyzing the records as applied to these cases.

GURVICH, I. I., "Application of Nonlinear Profiles with Refracied Waves," Prikladnaya Geofizika, No. 16, pp. 85-97, 1957, (Transiated from Russian), Contract SD-78.

VESIAC 12,013 VU

This analysis shows that the use of nonlinear profiles in surveying gently sloping siructures can lead to substantiai errors. The presence of small variations of the velocity discontinuity, which are difficult or impossibie to establish experimentally, can nevertheiess result in a considerable distortion of the profile.

As a result false struciures may appear or the shape of the existing structures may be strongly distorted.

A comparison of structural profiles aiong the same profile, obtained at different distances of ihe source from the profiie, may serve as a criterion for determining the degree of constancy of the veiocity discontinuity.

The resulis of this investigation point to the need for an especialiy careful study of the velocity discontinuity in those regions in which the structures are not pronounced and the refraction method is used for surveying.

GUTDEUTSCH, R., "On Multiple Arrivais of Elastic Waves on Layers," Zeitschrift f Geophysik, Vol. 28, No. 2, pp. 53-78, 1962, (Translated from German), Contract SD-78.

VESIAC 7148 VU U

In this chapier ihe authors discuss the possibility of ihe occurrence of multiple arrivais on a layer of high wave veiocity in country rock of low velocity.

GUYTON, J. W., Study of Short-Period Seismic Noise, Semiannuai Tech. Summ. Rept. No. 3, Contraci AF 49(638)-1150, Geotechnicai Corp., Garland, Texas, 1963.

VESIAC 7483 VU
AD 431 768

This report gives results of studies of short-period seismic noise, signal levels, and signal-to-noise ratio performed under this contract. The report has five parts; each presents technical information on a subject of investigation. Part I gives resuits of a study of relative signal levels ai 27 seismograph stations in the U. S. Part II gives results of a study of relative signal-to-noise ratio at 26 seismograph stations. Part III describes the data processing capabiiity which is available for work on the project. Part IV describes the resuits of shallow refraction surveys of nine seismometer sites at WMSO. Part V gives preliminary results of the relation between seismograph sites and coupling of acoustic energy into the ground.

GUYTON, J. W., Study of Short-Period Seismic Noise, Final Rept., Contract No. AF 49(638)-1150, Geotechnical Corp., Garland, Texas, 1963.

VESIAC 6159 VU
AD 416 127

This report is a documentation of the status of Contract AF 49 (638)-1150, Study of Short-Period Seismic Noise, at the end of the first year of its duration. It is not intended to convey technical results, but to review the administrative and technical work completed and describe that which is continuing.

GUYTON, J. W., Systematic Deviations of Magnitude from Body Waves at Seismograph Stations in the United States, VESIAC Rept. No. 4410-71-X, Contr. No. SD-78, Univ. of Michigan, Inst. of Sci. & Tech., Ann Arbor, Mich., 1964.

VESIAC 8128 L VU
AD 441 592

Systematic deviations in determination of magnitude from short-period P phases have been determined for 27 stations in the United States. As many as 119 teleseisms were studied. The range of average deviation is 0.72 m, corresponding to amplitude variation by a factor of 5. It is possible that signal level is influenced by both a local factor, related to geologic foundation, and a regional factor, related to regional geologic setting. Similar results were reported for the USSR by Pasechnik (1962), who attributed variation among stations to differences of seismogeological structure.

GUYTON, J. W., J. H. HAMILTON and G. G. SORRELLS, Observations on the Effects of Site Differences and Instrument Emplacements on Signal and Noise Amplitudes, Contract No. ARPA Agency Document, Geotechnical Corp., Garland, Texas, 1963 (OFFICIAL USE ONLY).

VESIAC 7351 A VU O

GUYTON, J. W., J. H. HAMILTON and G. G. SORRELLS, Observations on the Effects of Site Differences and Instrument Emplacements on Signal and Noise Amplitudes, Contract Nos. VT/036, VT/1124, VT/4051, Geotechnical Corp., Garland, Texas, 1963 (OFFICIAL USE ONLY).

VESIAC 7410 VU O

HAIR, G. D., Advanced Array Research, Quarterly Rept. No. 1, 15 Dec. 1966 Through 14 March 1967, Project VT/7701, Contract F 33657-67-C-0708, Texas Instruments Inc., Dallas, Texas, 1967.

VESIAC 16,058 VU
AD 814 678

This report describes the present effort and the plans for future work in the areas of network studies, multisensor arrays, continuously adaptive filtering, near-array noise sources, and intra-array equalization studies.

HAIR, G. D., Advanced Array Research, Quarterly Rept. No. 2, 15 March 1967 Through 14 June 1967, Project VT/7701, Contract F33657-67C-0708, Texas Inst., Inc., Dallas, Texas, 1967.

VESIAC 16,639 VU

Progress during the second quarter, present effort and plans for future work in the areas of network studies, multisensor arrays, continuously adaptive filtering, near-array noise sources, and intra-array equalization studies are presented.

VESIAC 17,025 VU

HAIR, G. D., Advanced Array Research, Quarterly Report No. 3, 15 June 1967 Through 14 September 1967, Contract VT/7701, F33657-67C-0708, Texas Inst., Inc., Dallas, Texas, 1967.

Progress during the third quarter, present effort and plans for future work in the areas of network studies, multisensor arrays, continuously adaptive filtering, near-array noise sources, and intra-array equalization studies are presented.

VESIAC 18,323 VU
AD 834 225

HAIR, G. D., Advanced Array Research, Quarterly No. 1, Project VT/7701, Contract F33657-67C-0867, Texas Inst., Inc., Dallas, Texas, 1968.

Progress is reported for those tasks active during the first quarter: Research on Adaptive Processing Techniques, Evaluation of the Expanded SP Array at TFO, Evaluation of the 7-Element LP Array at TFO, Analysis of WMO Vertical and Horizontal Component Ambient Noise. Plans for the second quarter are reported for these and other tasks scheduled to begin during the second quarter.

VESIAC 18,780 VU
AD 839 353

HAIR, G. D., Advanced Array Research, Quarterly Rept. No. 2, 1 June 1968 to 31 August 1968, Contract VT/7701, F33657-68C-0867, Texas Inst., Inc., Dallas, Texas, 1968

Progress during the second project quarter is reported by task. Active tasks are: Research on adaptive processing techniques, Evaluation of the expanded SP array at TFO, Evaluation of the 7-element LP array at TFO, Continuous computation and display of high-resolution wavenumber spectra, and a Study of array performance improvement through expansion. Plans are reported for the third quarter for these and other tasks scheduled to begin during the third quarter.

VESIAC 19,154 VU
AD 844 691

HAIR, G. D., Advanced Array Research, Quarterly Rept. No. 3, 1 Sept. 1968 to 30 Nov. 1968, Contract VT/7701, F33657-68C-0867, Texas Inst., Inc., Dallas, Texas, 1968

Progress during the third quarter and plans for the fourth quarter are reported by task. Tasks reported are: Research on Adaptive Processing Techniques, Evaluation of the Extended SP Array and the 7-element LP Array at TFO, Research on Array Processing Techniques for 3-component LP Arrays, NORSAR Signal and Noise Analysis, Analysis of Special WMO Noise Data, Research on High-Resolution Frequency-Wavenumber Spectral Estimation and Research on Methods for Predicting Improvement in Array Performance Achievable through Array Expansion.

VESIAC 17,298 VU
AD 825 832

HAIR, G. D., Advanced Array Research, Quarterly Rept. No. 4, Contract VT/7701, F33657-67C-P001, Texas Inst., Inc., Dallas, Texas, 1968.

Progress during the fourth quarter and plans for several special reports and the annual report are presented. Tasks reported are: network studies, multisensor arrays, continuously adaptive filtering, and group coherence.

HAIR, G. D., Advanced Array Research, Quarterly Rept. No. 4, 1 Dec. 1968 to 28 Feb. 1969, Contract VT/7701, F33657-68C-0867, Texas Inst., Inc., Dallas, Texas, 1969

VESIAC 19,406 VU

Progress during the fourth quarter is reported by task. Tasks reported are: Research on Adaptive Processing Techniques, Evaluation of the Expanded SP Array and the 7-element LP Array at TFO, Research on Array Processing Techniques for 3-component LP Arrays, NORSAR Signal and Noise Analysis, Analysis of Special WMO Noise Data, Research on High-Resolution Frequency-Wavenumber Spectral Estimation and Research on Methods for Predicting Improvement in Array Performance Achievable through Array Expansion.

HAIR, G. D., J. P. BURG, A. H. BOOKER, and L. N. HEITING, Advanced Array Research, Final Rept., Contract VT/7701, F33657-68C-0867, Texas Inst., Inc., Dallas, Texas, 1969

VESIAC 19,752 VU
AD 855 397

A qualitative summary is presented of the objectives, results, and conclusions of eight research tasks directed toward the development of advanced seismic array data processing techniques. An appendix gives abstracts of ten special reports which present the quantitative results and detailed descriptions of the experiments.

Tasks reported are: adaptive processing techniques, long-period studies, NORSAR signal and noise analysis, minimum-phase equalization, high-resolution wavenumber spectral techniques, analysis of WMO noise spectral lines, and prediction of array processing gains through array expansion.

HAIR, G. D., and J. H. FUNK, Noise Study, Spec. Rept. No. X, Contract AF 19(604)-8517, Texas Instr., Inc., Dallas, Texas, 1964.

VESIAC 9172 VU

Worldwide seismic noise levels and characteristics for 1963 are discussed. Data for evaluation includes absolute power and density spectra and contour maps of average worldwide microseismic activity. Relative power density spectra were computed from 1963 data from Worldwide Standard Stations. Discussed are the slopes of the least-mean-square line through the power density points that were com-computed, and a pattern of slope changes which was observed between 1 cps and 2 cps. This suggests two separate sources generating microseisms above and below 1 cps, respectively; it suggests that the spectra above 1 cps are independent of storms, fronts, etc. Spectra for frequencies less than 1.0 cps show greater seasonal variations.

HAIR, G. D., W. P. HANEY, W. A. JOHNSON, and R. W. ROZEBOOM, Large-Array Signal and Noise Analysis - Special Sci. Rept. No. 1 - A Study of the Relative Capability of Large and Small Seismic Arrays for Event Identification, Project VT/6707, Contract AF 33(657)-16678, Texas Inst., Inc., Dallas, Texas, 1967.

VESIAC 16,367 VU
AD 815 686

An ensemble of 38 teleseismic earthquake and underground explosion events recorded by the short-period LASA was analyzed to measure the relative capability of large and small seismic arrays to identify source type. Identification parameters measuring P-coda complexity and relative spectral content were computed for two subarray outputs and the large-array output and compared both statistically and for individual events. Techniques for improving the detectability of depth phases and aftershocks, though originally developed for network application, also were examined by treating the 21 subarrays as elements of a network.

HAIR, G. D., R. W. ROZEBOOM, An Experiment in Event Detection and Location with LASA Wavenumber Spectra - Advanced Array Research, Special Rept. No. 14, Contract VT/7701, F33657-67C-0708, Texas Inst., Inc., Dallas, Texas, 1968.

VESIAC 17,987 VU
AD 831 051

This report describes an experiment testing a technique for the simultaneous detection and epicenter location of seismic events. The technique, which consists of computing high-resolution frequency-wavenumber spectra for each of a series of adjacent or overlapping time gates, is applicable to any array station.

HALES, A. L., A Cooperative Onshore-Offshore Seismic Experiment, Annual Report, Contract AF 49(638)-1542, Graduate Research Center of the Southwest, Dallas, Texas, 1966.

VESIAC 14,103 VU

The East Coast On-Shore Off-Shore Experiment shooting program for the southern profiles began 19 June and ended 30 June 1965. Forty-four 1-ton, two 10-ton, eighteen 20-lb and seventy-seven 100-lb shots were fired. Shooting on the northern profiles began 6 July and ended 19 July 1965. Thirty-nine 1-ton, seven 5-ton, eight 20-lb and one hundred eighteen 100-lb shots were fired.

HALES, A. L., An Extended Program of Crustal Structure Studies in South Africa, Quarterly Rept., Contract SD-82-G-1, Univ. of Witwatersrand and S. Africa, South Africa, Undated.

VESIAC 5577 VU

This quarterly report calls brief attention to two matters: 1) the fact that Project A—field confirmation of earlier results of anomalous travel times for the Northern Transvaal—was interrupted due to reallocation by the South African Post Office of frequencies in the 40 Mc/s band, and 2) the fact that adjustments to the phase calibration equipment and the seismometers was in progress at the end of the period under review.

HALES, A. L., Gravity Anomalies and Crustal Structure, VESIAC Rept. No. 4410-75-X, Contr. No. SD-78, Univ. of Michigan, Inst. of Sci. & Tech., Ann Arbor, Mich., 1964.

VESIAC 8217 A VU

Woollard has stated that gravity and seismic information on crustal structure could not be correlated satisfactorily unless the composition of the crust is known. The thickness of crusts in isostatic equilibrium vary widely. In its simplest form, the condition for isostatic equilibrium is that the mass above any arbitrary reference level is the same whatever the elevation of the surface. This is illustrated here. Also shown is that comparisons of oceanic and continental crustal structures tend to support the view that the mean crustal density in continental areas is higher than 2.67 (gm/cm)^3. Other conclusions are also drawn.

HALES, A. L., Research Directed Toward Detecting Regional Differences in the Earth's Mantle, Contr. No. AF 19(628)-2936, Graduate Res. Center of the Southwest, Dallas, Texas, 1964.

VESIAC 7699 VU
AD 437 244

A pilot study using four earthquakes was concluded in December 1963. The study assumed that each residual from the Jeffreys-Bullen travel times consisted of two parts: 1) an error in the J-B travel time for a particular epicentral distance; 2) a "station correction", effectively constant over the range of epicentral distances being considered. Results were consistent, pointing to a valid model. Since 1963, the number of seismograph stations in the U. S. has considerably increased making it possible to conduct a reappraisal of wave travel times across the continent, using naturally occurring quakes. Presented are some first results from a P wave study, in the range of 30° to 90°, utilizing this increased station coverage, and station corrections from a least squares analysis.

HALES, A. L., Research Directed Toward Detecting Regional Differences in the Earth's Mantle, Semiannual Rept., Contract AF 19(628)-2936, Graduate Res. Center of the Southwest, Dallas, Texas, 1964.

VESIAC 9450 VU

This report states that in addition to station corrections and those given to the J. B. tables, obtained from 11 earthquakes along an azimuth northwest of the U. S., 8 earthquakes to the South and 6 to the east and northwest have been added.

Biasing of results in the last report occurred from use of data from one azimuth only. This bias has been removed by the addition of other azimuths to the analysis. The report specifies the steps taken to consolidate the positions already reached, including the deviation curve obtained from analysis.

HALES, A. L., Research Directed Toward Detecting Regional Differences in the Earth's Mantle, Annual Report, Contract AF 19(628)-2936, Grad. Res. Center of the Southwest, Dallas, Texas, 1966.

VESIAC 14,829 VU
AD 802 753

Work reported on in this annual report has to do with: (a) station residuals and travel times, and more specifically a paper entitled "An Analysis of the Travel Times of P Waves to North American Stations, in the Distance Range 32° to 100°," by J. R. Cleary and A. L. Hales; (b) Azimuthal dependence of residuals, which concerns a program that plotted station residuals as a function of azimuth, for each event as a function of distance, and for each station as a function of distance; (c) the application of the Herglotz-Wiechert procedure to the travel times using two models of the upper mantle structure; (d) effect of variations of upper mantle structure on station residuals; (e) effect of variations of velocity-structure near the core boundary; (f) S-wave travel times; (g) use of digital procedures for identification of the S phase.

HALES, A. L., Semiannual Technical Summary Report Ending September 30, 1963, Contract No. SD-82-G-1, Univ. of Witwatersrand, S. Africa, 1963.

VESIAC 6874 VU

The field recording equipment was operated at four stations at varying distances south of Johannesburg under Project A. Preliminary analysis of the records shows that the travel times for Pn waves along this path were within one second of those of corresponding distances to the north of Johannesburg. Project B was a study of surface wave velocities. Seismometers (illustrated here) built for this project have a natural period of 20 seconds and an inertial mass of approximately one kgm. Tables show the list of earthquakes recorded up to 31 August 1963. Other aspects of Project B are discussed.

HALES, A. L., Travel Times from Lake Superior Shots, 1966, Quarterly Report, Contract AF 49(638)-1746, Graduate Res. Center of the Southwest, Dallas, Texas, 1966.

VESIAC 14,964 VU

This report contains a list of stations occupied during Project Early Rise. Most of the magnetic tapes have been replayed and are being analyzed.

HALES, A. L., Travel Times from Lake Superior Shots, 1966, Tech. Interim Rept., Contract AF 49(638)-1746, Southwest Center for Advanced Studies, Dallas, Texas, 1967.

VESIAC 15,531 VU

In this interim technical report, the latitudes and longitudes of the stations occupied by the Southwest Center for Advanced Studies Group are given. Also included is a description of equipment. Eight stations used analog tape recorders built for use in buoys at sea. Each station has one vertical H.S. 10-1 seismometer and one vertical H.S. 10-2 seismometer. The first-arrival times are given in the table of results. Comments on the observations are given, as well as comments on the amplitudes and modal calculations.

HALES, A. L., R. W. GREEN and L. O. NICOLAYSEN, Report On ARPA Project SD-82-G-1 for Period Ending 31 March 1964, Contr. No. SD-82-G-1, Univ. of Witwatersrand, S. Africa, 1964.

VESIAC 7719 VU

This is a report on Project A (a travel-time study) and Project B (Long-Period Program) carried out in the Union of South Africa. The records of four stations (Bloemfontein, Jagersfontein, Philippolis and Hanover) have been analyzed. Attached as appendices are: a preliminary account of the calculations, a table of the travel time for the four stations, reduced travel time plots showing deviations in travel time at the stations on the Southern and Northern Traverse.

HAMILTON, J. H., Summary of Long-Period Seismograph Work at Geo-Tech., Tech. Rept. No. 64-121, Contracts: VT/036, AF 33(600)-41318, VT/072, AF 33(600)-41824, VT/074, AF 33(600)-41694, VT/4051, AF 33(657)-12145, and VT/4054, AF 33(657)-13562, Geotech. Corp., Garland, Texas, 1964.

VESIAC 15,317 VU

This report summarizes work on long-period seismographs by The Geotechnical Corporation between 1960 and 1964. It is essentially a collection of illustrations from previous reports. The effort on long-period seismographs by Geotech has been concentrated primarily on development of instrumentation and installation techniques suitable for field operation at mobile and semipermanent observatories. During this three year period, the operating magnification of a long-period seismograph has been extended from about 1K to over 100K. Principal limitations, and advantages of operation in a borehole are discussed.

HANDIN, J. W., Rock Failure in Torsion Tests, Semiannual Tech. Rept. No. 1, Contract No. AF 19(628)-2784, Shell Development Co., Houston, Texas, 1963.

VESIAC 6603 VU

During this reporting period we have rejuvenated the torsion testing apparatus, designed and built a new, more sensitive force-torque gauge, and made about 30 torsion tests, 6 triaxial extension tests, and 12 "Brazil" tests on solid cylinders of Solenhofen limestone. Although the data of torsion tests reflect a reasonably consistent tendancy for strength to increase with mean pressure and a brittle-ductile transition midway between those observed in triaxial compression and extension tests, we must conclude that these data on solid cylinders are not directly comparable with those from other types of tests. This is because the shear stress in twisted solid cylinders is not uniform.

HANDIN, J. W., Rock Failure in Torsion Tests, Semiannual Tech. Rept. No. 4, Contract AF 19(628)-2784, Shell Development Co., Houston, Texas, 1965.

VESIAC 10,498 VU

In Project SHOAL, a low-yield nuclear device was to be detonated underground in granodiorite at a site approximately 28 miles southeast of Fallon, Nevada. The U. S. Army Engineer Waterways Experiment Station determined pertinent physical properties of the granodiorite (as described in the appendix) and developed a grout mixture with similar properties for use in embedding instruments to measure earth motion, a particle motion, etc. Two other mixtures were developed to meet less rigid requirements. In all, WES grouted 10 surface stations, 4 surface and 30 tunnel instrument holes, 5 instrument niches, and 1 exploratory hole. Physical properties of the grout on the device-detonation data are given.

HANDIN, J. W. and H. C. HEARD, Rock Failure in Torsion Tests, Semiannual Tech. Rept. No. 3, Contr. No. AF 19(628)-2784, Shell Development Co., Houston, Texas, 1964.

VESIAC 8744 VU

This report gives results of experiments of rock failure (Solenhofen limestone) in torsion tests. Section I reviews experimental objectives and theory; Section II summarizes the experimental results of triaxial compression tests; Section III summarizes experimental results of extension tests; Section IV discusses torsion tests on solid cylinders; Section V discusses torsion tests on hollow cylinders; Section VI discusses the results of the experiments. The effect of the intermediate principle stress on the failure of rock has been clearly demonstrated for the first time. At present, the understanding of this effect is qualitative, but the authors are searching for an adequate analytical relation for quantitative prediction.

HANDIN, J. W., and H. C. HEARD, Rock Failure in Torsion Tests, First Annual Report, Contract AF 19(628)-2784, Shell Development Co., Houston, Texas, 1966.

VESIAC 14,329 VU

Strength and ductility of ordinarily brittle substances are commonly observed to increase with mean pressure. However, in the last 50 years it has been recognized that the effects differ from compression to extension tests, where subscripts denote maximum, intermediate, and minimal (compressive) stresses. The author subjected jacketed cylinders to combined triaxial compression or extension and torsion. Discussed is how the data from different types of tests are compared.

HANEY, W. P., Large-Array Signal and Noise Analysis - 2. Research on High-Resolution Frequency Wavenumber Spectra, Project VT/6707, Contract AF 33(657)-16678, Texas Inst., Inc., Dallas, Texas, 1967.

VESIAC 16,638 VU

This report presents the results of research performed to optimize the technique of computing high-resolution frequency-wavenumber spectra. Research indicated that, for the detection, location and identification of P-wave energy as recorded at an array such as LASA, the following requirements should be maintained: (1) power density spectral estimates obtained by a direct transform method rather than a correlation method should be smoothed only after the crosspower products have been formed, (2) SNR used in the filter development should be in the order of 0.1 to 0.01, (3) the reference sensor should be on the extremity of the array, (4) data gate length should include at least 50 to 60 sec of data, and (5) correction for travel-time anomalies should be made when using LASA data.

HANNON, W. J., The Effect of the Crust on Body Waves, Semiannual Tech. Rept. No. 6, Contract No. AF 19(604)-7399, St. Louis Univ., St. Louis, Mo., 1963.

VESIAC 6855 B VU

The effect of the crust on incident P waves was determined for six crustal models using the Haskell-Thomson Matrix Method on the IBM 1620 and 7070 computer systems. The models and their characteristics are given in Table 1. Preliminary results for the first four models can be seen in Figures 1 and 2.

HANNON, W. J., Some Effects of a Layered System on Dilational Waves, Contract No. AF 19(604)-7399, St. Louis Univ., St. Louis, Mo., 1964.

VESIAC 8443 VU
AD 444 911

The effect of the crustal model on the variation of the surface motion with the angle of incidence and the frequency is examined for several crustal models. Explained is how the study was carried out by programming the problem for the IBM 1620 and 7072 computer systems using the matrix formulation originally suggested by Thompson, and perfected by Haskell and Dorman. The author describes how six crustal models having such features as thin low-velocity surface layers, low-velocity layers at depth, and relatively thin total thicknesses were developed. The operations with these models are discussed. As a result of the calculations in this report, the importance of the frequency dependent character of the crustal effect has been further emphasized.

HANSON, M. E., and A. R. SANFORD, Some Characteristics of a Propagating Brittle Tensile Crack, Semi-Annual Tech. Rept., Contract F44620-70C-0055, New Mexico Inst. of Mining & Tech., Socorro, N. M., 1970

VESIAC 20,303 VU

A numerical technique was used to formulate the two-dimensional equations of motion for an elastic continuum. A brittle tensile crack was simulated to form and propagate in the continuum. The stress field in front of the fracture tip was found to become increasingly hydrostatic with increasing fracture velocity. A fracture criterion in terms of the values of the principal stresses near the fracture tip indicated a terminal velocity for a straight running fracture of approximately 0.39 of the dilatational wave speed. Part of the elastic energy residing initially in the continuum accumulated at the fracture tip. A quantitative fit of elastic energy as a function of crack half-length and velocity showed that energy increases with fracture length and decreases with fracture velocity.

HANSON, M. E. and A. R. SANFORD, A Two-Dimensional Source Function for a Dynamic Brittle Bilateral Tensile Crack, Contract F44620-67C-0113, New Mexico Inst. of Mining and Tech., Socorro, N. M., 1969

VESIAC 19,914 VU

A numerical technique is used to simulate the two-dimensional elastic dynamic characteristics of a bilateral tensile fracture that accelerates, propagates, and stops in an elastic continuum. The fracture-velocity function is specified for the calculation. Particle motion in the near field about the final fracture geometry is the result. Motion parallel to the fracture amounts to as much as 20% of the perpendicular motion at the quarter points of the crack axis. Relaxation begins to occur after the fracture stops and the dynamic elastic radiation from both tips crosses the material.

HANSON, M. E., A. R. SANFORD, and R. J. SHAFFER, A Source Function for a Dynamic Bilateral Shear Fracture, Tech. Rept., Contract F44620-70C-0055, New Mexico Inst. of Mining & Tech., Socorro, N. M., 1970

VESIAC 20,419 VU

A two-dimensional brittle bilateral shear crack was numerically simulated to form and stop in an elastic isotropic medium. The crack surface remained a straight line, but underwent rotation that was partially attributed to the starting of the crack and partially to the stopping of the crack. If the crack did not stop, the magnitude of rotation would be about half of the value obtained for this study. The largest displacement was parallel to the fracture and near the line of nucleation. The largest displacement perpendicular to the fracture occurred near the crack tips. Symmetric points across the fracture surface were found to have asymmetric displacements. The percentage difference of the displacements was largest beyond the crack tips, but the magnitude of the displacement difference was larger near the crack tips. The results of the study are displayed graphically.

HARDTWIG, E., "Approximation Formulas for the Reflection and Transmission Coefficients Resulting with the Reflection and Refraction of Elastic Waves at Discontinuities," Geofisica Pura e Applicata, Vol. 37, pp. 1-15, May-August 1957. (Translated from German), Contract DA 49-083 OSA-3137.

VESIAC 14,155 VU

At the incidence of a compressional wave at a plane interface between two elastic media, four secondary waves are generated — refracted and reflected compressional and shear waves. The amplitudes of these secondary waves and consequently the partition of energy of the incident wave among them depend on the physical constants of the media and on the angle of incidence of the primary wave. These values may be calculated by means of a system of four linear equations, but the expressions for the reflection and transmission coefficients (in general terms) are very complicated. Approximate formulae for these coefficients are deduced in this article.

HARDTWIG, E., "On the Origin of Microseisms," Ztschr. f. Geophys., Vol. 23, pp. 83-112, 1957, (Translated from German), Contract SD-78

VESIAC 9822 VU

A new theory of microseisms is developed. On the basis of the surprising finding of Ramspeck, that concrete pavements on a soft foundation behave in the manner of freely vibrating, elastic plates, the earth's crust is assumed to be an elastic plate superposed on a soft foundation, which is therefore freely vibrating. After a theoretical part, in which the different types of vibrations of freely vibrating plates are considered, the results, particularly the dispersion curves, are applied to the earth's crust, which is assumed to be a uniform granitic layer in the context of Jeffreys (with the assumption of thicknesses of 30, 33 and 34 km).

HARKRIDER, D. G., Propagation of Acoustical Gravity Waves from an Explosive Source in the Atmosphere (THESIS), AF-AFOSR-25-63, Calif. Inst. of Tech., Pasadena, Calif., 1963.

VESIAC 11,437 VU

A matrix formulation is used to derive the pressure variation for acoustic gravity waves from an explosive source in an atmosphere modelled by a large number of isothermal layers. Comparison of theoretical and experimental barograms from large thermonuclear explosions leads to the following conclusions: (1) The major features on the barogram can be explained by the super-position of four modes, (2) Different portions of the vertical temperature structure of the atmosphere control the relative excitation of these modes, (3) A normalized point source is sufficient to model thermonuclear explosions, and (4) The observed shift in dominance of certain frequencies with yield and altitude can be explained using the empirical scaling laws derived from the direct wave near the explosion.

HARKRIDER, D. G., Rayleigh and Love Waves from Sources in a Multi-Layered Elastic Half-Space, Contract No. AFOSR 25-63, Calif. Inst. of Tech., Pasadena, Calif., 1963.

VESIAC 6505 VU

A matrix formulation is used to derive integral expressions for time transformed displacement fields produced by simple sources at depth in a multilayered elastic isotropic halfspace. The integrals are evaluated for their residue contribution to obtain surface wave displacements in the frequency domain. The theory includes the effect of layering and source depth for Rayleigh waves from: 1) an explosive source; 2) a vertical point force; and 3) Rayleigh and Love waves from a vertical strike slip fault model. The latter source includes effect of fault dimensions and rupture velocity. The theory is the basis for numerical computation of theoretical seismograms for use in a later paper for a comparison between observations and theory in the time and frequency domain.

HARKRIDER, D. G., Research on Theoretical Seismology, Annual Rept., Contract AF 49(638)-1693, Brown Univ., Providence, R. I., 1967.

VESIAC 16,730 VU

The work conducted in theoretical seismology in the period Feb. 1966 through Feb. 1967 is summarized.

HARKRIDER, D. G., Research on "Theoretical Seismology", Final Rept., Contract AF 49(638)-1693, Brown University, Providence, R. I., 1968.

VESIAC 18,139 VU

This document serves as a final report under the above named contract. It reviews the research accomplishments which have been described in technical papers already submitted to the sponsoring agency. It also reports on research in progress at the time of termination of the contract which research will be continued under the succeeding research contracts.

HARKRIDER, D. G., Surface Waves in Multilayered Elastic Media. 2. Higher Mode Spectra and Spectral Ratios from Point Sources in Plane Layered Earth Models, Contract F44620-68C-0082, Brown Univ., Providence, R. I., 1970

VESIAC 20,220 VU

Phase and amplitude spectra of Rayleigh and Love waves are presented for two earth models, one oceanic and one continental shield. The spectra of the first three Rayleigh modes and the first four Love modes are tabulated for point sources at selected depths. These tables along with computer algorithms described here allow one to estimate the amplitude spectra at non-tabulated source depths.

The use of spectral ratios as a means of determining source depth is investigated. A source depth of 20 km. is obtained for the Fallon earthquake of 20 July 1962. This depth agrees with previous estimates but the technique requires a fault plane orientation which differs from radiation pattern solutions.

HARKRIDER, D. G., Theoretical Acoustical-Gravity Wave Propagation, Final Rept., Contract F44620-67C-0006, Brown Univ., Providence, R. I., 1968

VESIAC 19,130 VU

This document serves as a final report under the above named contract. It reviews the research accomplishments which have been described in technical papers already submitted to the sponsoring agency. It also reports on research in progress at the time of termination of the contract which research will be continued under the succeeding research contracts.

HARKRIDER, D. G. and E. A. FLINN, Effect of Crustal Structure on Rayleigh Waves Generated by Atmospheric Explosions, Sci. Rept., Contracts: VT/6702, F33657-68C-0945, F44620-68C-0082, Brown Univ., Providence, R. I., 1969

VESIAC 19,404 VU

Theoretical seismograms are calculated at a teleseismic distance from atmospheric sources located over oceanic and continental earth models. Vertical surface displacements of the fundamental and first higher mode Rayleigh waves are obtained for each of the models. Source altitudes range from 1 to 16 kilofeet for a 1 kiloton nuclear explosion in a stratified thermal atmosphere. At 20 second period, an explosion over the oceanic model exhibits amplitudes of an order of magnitude greater than the equivalent amplitudes from an explosion of the same burst height and yield over any of the three continental structures. If the differences in anelastic attenuation over the paths are included, this effect will be reversed at sufficiently large distances.

HARKRIDER, D. G., and F. J. WELLS, The Excitation and Dispersion of the Atmosphere Surface Wave, Sci. Rept., Contract F44620-67C-0006, Brown Univ., Providence, R. I., 1968

VESIAC 18,763 VU

Atmospheric models terminated at altitude with a half-space, free surface or rigid surface all show a mode characterized by a long period velocity asymptote with a long period cut-off. This mode corresponds to the ocean surface wave mode with a long period velocity limit of $\sqrt{gH}$. Kinetic energy density profiles show that this early arriving wave travels in the upper atmosphere. Synthetic barograms indicate that it is most efficiently excited by sources higher than 130 km.

HARLEY, T. W., Large-Array Signal and Noise Analysis, Rept. No. 3 - Subarray Processing, Special Sci. Rept., Contract VT/6707, AF 33 (657)-16678, Texas Inst., Inc., Dallas, Texas, 1967.

VESIAC 17,022 VU

A theoretical Wiener multichannel filter was designed and applied to all operating subarrays for 14 noise samples and three signals. The filter system chosen had a disk signal model (11 km/sec to infinite velocity) and a noise annulus (2 to 6 km/sec) and exhibited good wave-number response to 0.2 cps. Preliminary analysis showed that it was necessary to equalize the noise at the low-frequency peak (0.2 to 0.3 cps) prior to processing to obtain consistent noise rejection at low frequency. Because of the peaked spectrum, equalization could be accomplished by adjusting the 25 channels in a subarray to have the same RMS noise level (i.e., 1-point equalization). Two measured-noise Wiener filters were designed using an infinite-velocity signal model (with 30-percent gain fluctuation added). Their noise rejection was about 2 db better than the theoretical system over most of the 0- to 5-cps band.

HARLEY, T. W., Large-Array Signal and Noise Analysis - Special Rept. No. 4, Space and Time Variability of the Short-Period LASA Noise Field, Special Sci. Rept., Contract VT/6707, AF 33(657)-16678, Texas Inst., Inc., Dallas, Texas, 1967.

VESIAC 17,604 VU
AD 825 202

To study the time and space variability of the LASA noise field, 13 noise samples were used. For every noise sample, power spectra were computed for both the output of seismometer 21 and the output of the multichannel filter system at each subarray. Finally, ratios of the individual spectra to the average spectrum were obtained for each noise sample. At the 0.2- to 0.3-cps microseismic peak, results were consistent for the 13 samples.

HARLEY, T. W., Long Period Array Processing Development, Quarterly Rept. No. 1, 21 Aprtl 1969 to 31 July 1969, Contract VT/9707, F33657-69C-1063, Texas Inst., Inc., Dallas, Texas, 1969

VESIAC 19,802 VU
AD 856 375

This quarterly report is a summary of progress under Long Period Array Processing Development, Contract No. F33657-69C-1063, during the period 21 April, 1969 to 31 July, 1969.

HARLEY, T. W., Long Period Array Processing Development, Quarterly Rept. No. 2, 1 August to 31 October 1969, Contract VT/9707, F33657-69C-1063, Texas Inst., Inc., Dallas, Texas, 1969

VESIAC 19,913 VU
AD 861 332

After the great Alaska earthquake of March 28, 1964, at 03:36: 13.0 (C&GS-03:36:14.0) (Greenwich Mean Time), seismologists from the Lamont Geological Observatory inttiated a program to study the microseismicity associatea with a major aftershock sequence. As one phase of the program, a few hundred microshocks were recorded during a 4-day pertod in July 1964 by two tripartite arrays of high-gain, high-frequency seismographs situated on the Kenai Peninsula. In the procedure to determine microshock hypocenters, a smoothed model of crustal velocities applicable to eastern Kenai Peninsula was constructed. The model was characterized by near-surface velocittes in the range 5.2 to 5.5 kilometers per second and by a marked increase in velocity to 7.5 kilometers per second at about 30 kilometers in depth.

HARLEY, T. W., Long Period Array Processing Development, Quarterly Rept. No. 3, 1 November 1969 to 1 January 1970, Contract VT/9707, F33657-69C-1063, Texas Inst., Inc., Dallas, Texas, 1970

VESIAC 20,079 VU
AD 864 882

This quarterly report is a summary of progress under Long Pertod Array Processing Development, Contract No. F33657-69-C 1063, during the period 1 November, 1969 to 31 January, 1970.

HARLEY, T. W., Long Period Array Processing Development, Quarterly Rept. No. 4, 1 February to 30 Aprtl 1970, Contract VT/9707, F33657-69C-1063, Texas Inst., Inc., Dallas, Texas, 1970

VESIAC 20,218 VU
AD 869 409

Thts quarterly report is a summary of progress under Long Period Array Processing Development, Contract No. F33657-69-C 1063, during the pertod 1 February, 1970 to 30 April, 1970.

HARLEY, T. W., Long Period Array Processing Development, Quarterly Rept. No. 5, 1 May to 31 July 1970, Contract VT/9707, F33657-69C-1063, Texas Inst., Inc., Dallas, Texas, 1970

VESIAC 20,338 VU
AD 872 892

This quarterly report is a summary of progress under Long Period Array Processing Development, Contract No. F33657-69-C-1063, during the period 1 May 1970 to 31 July 1970.

HARLEY, T. W., Long Period Array Processing Development, Quarterly Rept. No. 6, 1 Aug. 1970 through 31 Oct. 1970, Contract VT/9707, F33657-69C-1063, Texas Inst., Inc., Dallas, Texas, 1970

VESIAC 20,457 VU

This quarterly report is a summary of progress under Long Period Array Processing Development, Contract No. F33657-69-C-1063, during the period 1 August 1970 to 31 October 1970.

HARLEY, T. W. and M. BACKUS, Preliminary Report on the Study of Signal Equalization Techniques for Arrays, Contract No. VT/4053, AF 33(657)-12747, Texas Inst., Inc., Dallas, Texas, 1964.

VESIAC 8412 VU

The requirements of the study are such that the majority of the analysis will be done using events recorded on the large TFO cross-array. Analysis of one large CPO teleseism indicated that preliminary signal equalization improved the signal response of MIP No. 10 by three to five db in the frequency range of highest signal power (0.2 to 0.8 cps), did not change the response between 0.8 and 1.5 cps, and decreased the response between 1.5 and 2.5 cps (where signal power was down 20 to 25 db). The signal response of the summation was changed by equalization except at high frequencies (1.5 to 2.5 cps). Analysis of one large TFO teleseism indicated that there was considerable signal-generated, scattered energy in the P coda, which was propagating at low velocity (3 km/sec).

HARLEY, T. W., F. H. BINDER, J. P. BURG, and A. ALAM, Equalization Studies - Rept. No. 10, Large-Array Signal and Noise Analysis - Sci. Rept., Project VT/6707, Contract AF 33(657)-16678, Texas Inst., Inc., Dallas, Texas, 1967.

VESIAC 17,422 VU
AD 827 798

This report reviews the following four tasks pertaining to response equalization problems: evaluating a new technique using large signals for equalizing seismometers; examining the concept of designing regional equalization filters for subarray outputs; analyzing statistically the coefficients used to equalize the noise data; and developing the theory to incorporate statistical phase fluctuations in the correlation statistics.

HARLEY, T. W. and V. C. KENDALL, Intra-Array Minimum Phase Equalization, Advanced Array Research Special Rept. No. 8, Contract VT/7701, F33657-68C-0867, Texas Inst., Inc., Dallas, Texas, 1969

VESIAC 19,758 VU
AD 855 501

Filters constrained to be minimum-phase are designed and evaluated as intra-array signal equalization filters. Two events occurring close in space and time and recorded at the 37-element short-period TFO array are examined. Filter performance is good for the first few cycles of the P waves, but is poor for the remainder of the P coda. Cross-application of filters produces essentially the same degree of equalization as the filter designed specifically for the event.

HARLEY, T. W., T. W. REKIETA, Large-Array Signal and Noise Analysis - Special Sci. Rept. No. 11 - Separation of Time-Overlapping Short-Period Events, Contract VT/6707, AF 33(657)-16678, Texas Inst., Inc., Dallas, Texas, 1967.

VESIAC 17,989 VU
AD 831 467

Techniques for separating short-period time-overlapping events having similar epicenters were studied and, for the two pairs of events used, simple summation was found to be an effective separation technique. The signal-extraction filters which were designed were only partially successful. Apparently, the methods could be improved significantly by aligning the signals more exactly and by using substantially fewer channels in the filter design.

HARTENBERGER, R. A., The Effect of the Number and Spacing of Elements on the Efficiency of LASA Beams, Sci. Rept., Contract VT/6702, F33657-67C-1313, Teledyne, Inc., Alexandria, Va., 1967

VESIAC 17,214 VU
AD 824 795

LASA short-period recordings of 8 teleseismic earthquakes were prefiltered and beamsteered on P-wave arrivals across the 200 km. aperture to establish the relationship between sensor spacing and beam efficiency in terms of noise reduction, signal loss, and S/N ratio improvement.

Results show that the combined effect of increasing the number of elements in a beam while simultaneously reducing inter-sensor spacing is to produce progressively less rms noise reduction and S/N gain relative to N $1/2$.

The study further shows that beamforming each of the events in two ways, e.g., with 51 and 525 inputs, produces an average signal loss of ~4 db. Moreover, beaming the smaller number of traces reduces rms noise and improves S/N only about 1 db less than the 525-element beam. For the 51-element beam, the minimum sensor spacing was 6 km., the distance at which the short-period noise at LASA becomes incoherent.

HARTENBERGER, R. A., The Effect of the Number and Spacing of Elements on the Efficiency of LASA Beams, Supplement, Rept. No. 203, Contract VT/6702, F33657-68C-0945, Teledyne Indust., Inc., Alexandria, Va., 1968

VESIAC 19,158 VU
AD 844 582

A report entitled "The Effect of the Number and Spacing of Elements on the Efficiency of LASA Beams", was distributed on 21 December 1967. The study described the average signal loss, rms noise reduction, and S/N gain produced by beam forming eight teleseismic events two different ways.

Recently we extended the study still further by forming LASA beams containing 336 traces ($\Delta > 1$ km) derived from the 21 subarrays. We have beamformed the original eight events in this manner and the results are shown in Figures 1, 2, and 3 along with the results of the original and extended SDL studies.

HARTENBERGER, R. A., Power Spectra and Noise-Reducing Qualities of LASA Beams, Rept. No. 202, Project VT/6702, Contract F33657-67-C-1313, ARPA Order No. 624, Teledyne, Inc., Alexandria, Va., 1967.

VESIAC 17,137 VU
AD 824 375

The report discusses ways to reduce noise power levels by holding constant the number of long-period and short-period inputs and changing the spacing between adjacent sensors.

HARTENBERGER, R. A., R. H. SHUMWAY, A Beamforming Study Using Outputs from the Extended E3 Subarray at the Montana LASA, Contract VT/6702, F33657-67C-1313, Teledyne Indust., Inc., Earth Sci. Div., Alexandria, Va., 1967.

VESIAC 16,748 VU

Short-period seismograms representing nine teleseismic earthquakes recorded by vertical component instruments in the extended E3 subarray at the Montana LASA were bandpass-filtered and beamformed to determine the effect on average input SNR, signal, and noise.

Results of the study show that beamsteering all 25 outputs from the extended E3 subarray fails to improve the signal-to-noise by the square root of N, where N is the number of inputs to the beams.

The analysis further indicates that beams consisting of 3, 6, and 7 input traces prefiltered 0.4-3.0 cps reduce rms noise levels at the subarray by approximately $N^{1/2}$ at a minimum inter-sensor spacing equal to or greater than 6 kilometers.

HARTENBERGER, R. A. and R. VAN NOSTRAND. Influence of Number and Spacing of Sensors on the Effectiveness of Seismic Arrays, Sci. Rept., Rept. No. 252, Contract VT/9706, F33657-69C-0913, Teledyne Indust., Inc., Alexandria, Va., 1970

VESIAC 20,182 VU
AD 867 202

Ideally, geophones would be placed in a noiseless environment, in which case there would be no reason to resort to arrays of geophones. If the noise is such that an array is required, the objective of the array is to enhance the signal-to-noise ratio and thus to maximize the intelligence that can be derived from a given signal. The design of the array will be a function of the signal characteristics of the direction and velocity of the noise in the bandpass of the signal, and of the site geology.

It has been demonstrated that in a practical sense the optimum array processing is represented by precise beam forming by which we mean simple delay and summing. Increasing the number N of sensors within a given area decreases the inter-element spacing and may increase the coherency between noise samples at adjacent sensors, thus yielding poorer results compared to $\sqrt{N}$ improvement one expects to get. Increasing the number of sensors by proportionately increasing the area is liable to result in signal deterioration also yielding an unfavorable comparison to $\sqrt{N}$ improvement in signal-to-noise. These two effects, together with economical factors, combine to limit the number of sensors that can be used.

Although the data on which our conclusions are reached were drawn from earthquake seismology, the principles involved are equally applicable to exploration seismology and to other geophysical measurements in which arrays of sensors are required.

HAUBRICH, R. A., Microseism Measurements on the Deep Ocean Bottom, Sci. Rept., Contract AF 49(638)-1388, Univ. of Calif., La Jolla, Calif., 1970

VESIAC 20,416 VU

The study of seismic background on ocean bottoms is of practical and scientific importance. Practical, because oceans offer the only seismic access to significant areas of the earth where clandestine nuclear bombs might be fired underground. Scientific, because the ocean-bottom studies are given new quantitative answers to the 60-year puzzle of microseism origins.

To summarize, several laboratories have developed apparatus for ocean-bottom seismic measurements and have made a total of about 200 records in deep oceans. They have observed earthquakes, measured propagation velocities, studied microseism noise, and determined that signal-to-noise ratios may allow them to monitor bomb tests. But many more measurements will be needed before definitive generalizations can be made about the generation and attenuation of microseisms.

HEALY, J. H., Crust of the Earth, Technical Letter No. 25, Contract ARPA Order No. 193-64, U. S. Geological Survey, Washington, D. C., 1964. (OFFICIAL USE ONLY)

VESIAC 8880 VU O

HEALY, J. H., Study of Seismic Propagation Paths and Regional Travel-times in the Continental United States, Progress Report, Contract ARPA Order 193-64, U. S. Geological Survey, Denver, Colo., 1965.

VESIAC 13,786 VU
AD 470 328

This report discusses: a) The completion of the calibration of the Cumberland Plateau Seismological Observatory in June and the analysis of the data; b) The participation in the Onshore-Offshore Seismic Experiment; c) The preparation for, and the difficulties encountered in, making seismic recordings in Norway; d) The recording of small earthquakes in the Yellowstone, Colo. region.

HEALY, J. H., Variations in Regional Traveltimes, Contract ARPA Order No. 193-63, U. S. Geological Survey, Wash., D. C., 1964 (OFFICIAL USE ONLY).

VESIAC 7560 VU O
AD 432 708

HEALY, J. H., W. H. JACKSON, High-Frequency Content of Special Recordings, Tech. Letter Crustal Studies No. 40, Contract ARPA Order No. 193-65, U. S. Geological Survey, Denver, Colorado, 1965.

VESIAC 13,116 VU
AD 623 780

Recent interest in the high-frequency content of teleseismic signals led the authors to try a simple experiment with LONGSHOT. Three recording trucks, named in the report, were stationed along a line at 4-km intervals in the Golden Gate Canyon to the west of Denver. Geophones and filter settings were used to get the high-frequency portion of the signal on magnetic tape with sufficient dynamic range for analysis. Samples of monitor records show characteristic teleseismic arrivals at different filter settings. An exceptionally strong P_cP recorded within a few seconds of the Jeffreys-Bullen time curves is discussed, and high-frequency content of the signal.

HEALY, J. H., W. H. JACKSON, and D. H. WARREN, Preliminary Seismic-Refraction Studies for Project DRIBBLE, Contract ARPA Order No. 193-63, U. S. Geological Survey, Denver, Colorado, 1963. (OFFICIAL USE ONLY)

VESIAC 5136 VU O

HEALY, J. H. and G. B. MANGAN, A Progress Report on Seismic Model Studies, Contract ARPA Order No. 193-63, U. S. Geological Survey, Wash., D. C., 1963 (OFFICIAL USE ONLY).

VESIAC 7561 VU O
AD 428 648

HEAPS, S. N., Long-Period Triaxial Seismometer, Contract No. VT/072, AF 33(657)-9967, Geotechnical Corp., Garland, Texas, 1964.

VESIAC 8483 VU
AD 446 577

Long-period triaxial seismometer was built and tested. It has a central column supporting three LaCoste-type pendulums at 120-deg intervals. Three 13.23-kg masses are supported at 35.3 deg above the horizontal. The pendulums swing on crossed-flexure pivots with periods adjustable from 15 to 30 sec. Moving coil transducers provide damping of the three pendulums and generate signal power representing the orthogonal components of earth vibration velocity. Each transducer has a generator constant of 86 v/m sec, a signal-coil resistance of 570 ohms, and a CDR of 1700 ohms at a period of 25 sec. The motor constant of the calibration coils is given. A remote mass-centering motor and a remote mass-position monitor are provided for each pendulum.

HEARD, H. C., Rock Deformation and the Deformation Mechanisms in Torsion Tests - March 1963 - Feb. 1967, Final Sci. Rept., Contract AF 19(628)-2784, Shell Develop. Co., Houston, Texas, 1967.

VESIAC 16,371 VU

Several different types of triaxial deformation apparatus were employed to deform a variety of common rocks and single crystals at confining pressures to 10 kb, temperatures to 1,000° C, and strain rates ranging between 10^{-3} and 10^{-7}/second. Most samples were jacketed in thin metal tubes and tested dry in extension, torsion, compression, or compression plus torsion. Deformation mechanisms ranged from fracture, faulting through intragranular glide to recrystallization, depending on the test environment and rock type.

HEARD, H. C., and N. L. CARTER, Rock Failure in Torsion Tests, Third Quarterly Status Report, Contract AF 19(628)-2784, Shell Development Co., Houston, Texas, 1966.

VESIAC 14,630 VU

This article reports progress of a study on the behavior of rocks in torsion tests. The transition from brittle to ductile for Solenhofen limestone and Blair dolomite was explored. A large shipment of Brazilian quartz crystals were found suitable for experimentation. Work continued on the electron microscope studies of microstructures in deformed quartz, and on the study of slip mechanisms in rocks.

HECHT, R., J. KENNEDY, J. STRANGE and D. YOUNG, et. al., Comparison of Hydroacoustic Shock Waves from Four Different Explosives, Sci. Rept., Contract Nonr 4026(00), Underwater Systems, Inc., Silver Spring, Md., 1967

VESIAC 19,161 VU

Four different chemical explosives were detonated at a depth of 70 feet in Mono Lake, California for the purpose of comparing their efficiency in generating seismic signals. The hydroacoustic shock waves were examined to determine source levels, for comparison with received seismic signal levels. Excellent agreement between hydroacoustic and seismic signal levels were observed.

HEIRTZLER, J. R., Simultaneous Geomagnetic Measurements on an Ice Island Surface and 1000 Feet Below, Contr. No. NONR 266(82), Lamont Geol. Observ., Palisades, N. Y., 1963.

VESIAC 8256 VU

For a few weeks in the fall of 1962 the total geomagnetic field intensity was measured simultaneously on an ice island surface and 1000 ft. below. The magnetic gradient as indicated by the difference between the two readings varied as the station passed over geologic bodies. A statistical analysis of the time variations during two time intervals revealed an attenuation and phase shift of the lower head reading with respect to the surface head reading. The analysis was made between 70 and 400 sec period. There are indications of an anomalous attenuation at the lower period end of this band although the experiment was not such that accurate determinations could be made.

HEITING, L. N., Large-Array Signal and Noise Analysis, Special Sci. Rept. No. 20, Long-Period Summation Processing, Contract VT/6707, AF 33(657)-16678, Texas Inst., Inc., Dallas, Texas, 1968

VESIAC 19,042 VU
AD 841 673

Ten LASA long-period event records were demultiplexed and displayed for use in a signal extraction study. In addition, time-shift-and-sum outputs of the vertical, horizontal inline, and horizontal transverse elements were formed for several of the events. Appropriate Rayleigh wave velocities were used for the vertical and inline sums, while the transverse elements were beamed with Love wave energy.

HEITING, L. N., Large-Array Signal and Noise Analysis, Special Sci. Rept. No. 23, Long-Period Signal Separation, Contract VT/6707, AF 33(657)-16678, Texas Inst., Inc., Dallas, Texas, 1968

VESIAC 19,045 VU
AD 842 354

The problem of extracting the Rayleigh phase of an event of interest from a time-overlapping Rayleigh phase of another event was studied. Various configurations of the long-period LASA sensors and the following processing schemes were investigated: beamsteer processing using the great circle route and the dispersive curve velocity occuring at the peak power frequency; Wiener signal-extraction multichannel filter processing; and a nonconventional adaptive filter processing scheme.

HEITING, L. N., Multicomponent Long-Period Signal Separation, Advanced Array Research Special Rept. No. 6, Contract VT/7701, F33657-68C-0867, Texas Inst., Inc., Dallas, Texas, 1969

VESIAC 19,756 VU
AD 855 500

This report discusses several processors, designed and evaluated on long-period LASA data, for separating time-overlapping Rayleigh-wave arrivals. It has been observed in an earlier report that large-aperture vertical seismometer array processors (diameter~120km) did not show the expected superiority over small-aperture array processors (diameter~30km). It was tentatively concluded that loss of signal coherence resulting from waveform variations across the large array interferes with effective coherent processing. The first portion of this report deals with confirmation of this conclusion. Based on these results, a suggestion is made for possible improvement of the performance of small-aperture vertical seismometer array processors. The major part of the report deals with several types of 3-component processors. It is demonstrated that multichannel filters (MCF) employing 3-component instruments can significantly outperform a corresponding processor using vertical components alone. However, the 3-component processor shows about 3 db of signal attenuation; none was observed with the vertical component processor. Further work on this problem is recommended.

HEITING, L. N., Theoretical Performance of Long-Period 3-Component Multi-channel Filter Processor, Advanced Array Research Special Rept. No. 4, Contract VT/7701, F33657-68C-0867, Texas Inst., Inc., Dallas, Texas, 1969

VESIAC 19,754 VU
AD 855 399

A theoretical study of optimum processing techniques for 3-component long-period seismic arrays is presented. Mathematical models in the form of crosspower matrices are constructed for various proportions of random, directional Rayleigh- and Love-wave noise and isotropic Rayleigh- and Love-wave noise. These models are used to compare a variety of multichannel processing techniques and different array configurations. Gains to be expected from using 3-component rather than vertical-component long-period instruments are estimated.

HEITING, L. N., J. P. BURG, Theoretical Crosspower and Crosscorrelation Between Seismometer Outputs, Advanced Array Research, Spec. Rept. No. 5, Project VT/7701, Contract F33657-67C-0708, Texas Inst., Inc., Dallas, Texas, 1968.

VESIAC 17,432 VU
AD 827 787

In designing multichannel filters, it is frequently necessary to compute the required signal and noise crosspower or crosscorrelation matrices corresponding to theoretical models in frequency-wavenumber space. This report describes a general technique for accomplishing these computations. The method is applicable to models of the various types of wave propagation, and to the various types of sensors such as vertical or horizontal displacement or strain seismometers located at any depths. The propagating medium is considered to be a horizontally stratified series of homogeneous layers overlying a homogeneous halfspace. The flexibility of the technique is illustrated.

HEITING, L. N., J. P. BURG, and A. ALAM, Extraction of a Directional Signal from Isotropic Noise of the Same Speed - Advanced Array Research, Special Rept. No. 9, Project VT/7701, Contract F33657-67C-0708, Texas Inst., Inc., Dallas, Texas, 1968.

VESIAC 17,424 VU
AD 827 788

A theoretical comparison is made between Wiener multichannel filtering and beamsteer processing for arrays of long-period vertical seismometers. A 7 - and a 19-element array are considered. Both are arranged on a hexagonal grid with 20-km spacing between elements. The signal is a Rayleigh wave propagating in a specific direction at 3 km/sec. The noise consists of an isotropic component, also propagating at 3 km/sec, and of a small amount of random energy.

The principal result is that MCF processing in this particular situation is significantly better than beamsteering only below 0.05 Hz, where neither processor approaches a $(n)^{0.5}$ SNR ration improvement At higher frequencies, the improvement provided by either processor oscillates about the $(n)^{0.5}$ level as a function of frequency.

HEITING, L. N., S. A. RIZVI, Signal Enhancement with an Array of Vertical and Horizontal Seismometers - Advanced Research Array, Special Rept. No. 11, Contract VT/7701, F33657-67C-0708, Texas Inst., Inc., Dallas, Texas, 1968.

VESIAC 17,985 VU
AD 831 569

Previous theoretical studies have indicated that arrays consisting of rings of radially oriented horizontal seismometers concentric with a central vertical seismometer are useful for the extraction of P-wave signals from Rayleigh-wave noise. To test this hypothesis, data were recorded at WMO from an experimental array having two horizontal rings and a central vertical seismometer. This report presents the results of processing the data.

HELLBARDT, G., "Seismic Experiments on an Ice Sheet," Ztschr. f. Geophys., Vol. 21, pp. 41-47, 1955, (Translated from German) Contract SD-78.

VESIAC 9532 VU

The propagation of elastic waves was observed in an ice sheet. Dilatational, SH (Love) and flexural waves were observed as well as unexplained arrivals. The velocities measured and the elasticity constants calculated from them are in good agreement with the results of other authors and with theory. A calculation of the propagation of pulses in the presence of dispersion illustrates the generation of wave trains in the seismograms.

HEMDAL, J. F., Collection and Analysis of Seismic Wave Propagation Data-Supplement 2: An Error Analysis of Digital Equalizing Filters, Rept. No. 5178-64-F_2, Contract AF 49(638)-1170, Univ. of Mich., Inst. of Sci. and Tech., Ann Arbor, Mich., 1966.

VESIAC 14,988 VU
AD 639 435

A program to determine the digital operator and to compute the mean-square-error between the filtered result and the desired signal was written for an IBM 7090 computer. The computed errors for typical seismic signals are presented as a function of operator length, signal length, and the number of records used to determine averages. Results suggest that equalization occurs both as a process of signal shaping and of noise reduction, but not necessarily simultaneously.

HEMELRICK, L. V., A Lunar Long-Period Seismometer and a Laser-Transducer Seismometer, VESIAC Rept. No. 4410-77-X, Contr. No. SD-78, Univ. of Michigan, Inst. of Sci. & Tech., Ann Arbor, Mich., 1964.

VESIAC 8865A VU
AD 452 161

Seismic instruments whose responses permit measurement of long-period components of earth motion have been and are under development at Lamont Geological Observatory. The two instruments described in this report are: a) the lunar 4-component seismometer; and b) the laser-transducer seismometer. Photographs and figures accompany the report.

HENNEN, F. M., Interim Report on Long-Period Tests at LASA Subarray F3, Rept. No. TR 65-106, Project VT/4051, Contract AF 33(657)-12145, Teledyne Indust., Inc., Geotech Div., Garland, Texas, 1965.

VESIAC 17,132 VU
AD 818 284

A program to evaluate techniques for installing long-period seismographs is continuing at LASA subarray F3. The major tests performed during the period covered by this report include: load and tilt tests on the seismometer vault, various tank and vault sealing combinations, phase coincidence tests, temperature stability tests, and tests of the effect of wind buffeting against the vault entry.

HERRERA, I., Contribution to the Linearized Theory of Surface Wave Transmission, Contr. No. AF-AFOSR 26-63, Univ. of Calif., Los Angeles, Calif., 1964.

VESIAC 8593 VU

This paper is concerned with the scattering of surface waves by small perturbations in the elastic medium. A radiation condition is obtained which does not depend on the rate of decay of the waves at infinity. The representation theorems of elastodynamics are then extended to a multilayered half space. The first order perturbation theory of elastic wave propagation which the author is developing, when applied to problems of surface wave transmission yields results which can be most elegantly stated introducing the notion of surface wave content as a point. In this manner a one-dimensional transmission model is obtained.

HERRERA, I., A Perturbation Method for Elastic Wave Transmission, III. Thin Inhomogeneities, Contr. No. AF-AFOSR 26-63, Univ. of Calif., Los Angeles, Calif., 1964.

VESIAC 8592 VU

A first order theory is developed to treat the scattering of elastic waves by small inhomogeneities. Attention is restricted to inhomogeneities for which the perturbation of the elastic properties is not small but the perturbed region is thin. Geological formations satisfying these conditions are dykes, lenses, etc. Using the integral representation theorems of elastodynamics the solutions are expressed as integrals of known quantities.

HERRIN, E., Determination of Epicenters in the Soviet Union, Contract AF-AFOSR-414-64, Southern Methodist Univ., Dallas, Texas, 1964.

VESIAC 8988 VU

A simulation or Monte Carlo method is used to estimate the precision with which a hypothetical network could determine epicenters in the USSR. Coverage ellipses for probabilities of 0.90, 0.75, and 0.50 are given for events of magnitude 4, 5 and 6 at a number of locations. The range of areas is given in a table. Considering the added problem of travel-time bias in uncalibrated regions, the addition of 7 "unmanned" stations within the USSR to the "national" network of 23 stations would not be expected to improve significantly the capability of the network for locating seismic events in the USSR.

HERRIN, E., Errors in Epicenter Locations, Contr. No. AF-AFOSR-414-63, Southern Methodist Univ., Dallas, Texas, 1964.

VESIAC 7848 VU

Discussed is a method for studying errors of dispersion and of bias in epicenters located by particular networks of seismic stations. In the USA, stations that have actually recorded underground explosions are used. In the USSR, a selection of largely hypothetical stations are considered. The researchers discovered that the time travel functions are not linear, and thus, are not exactly known. Also, the station means and variances are not exactly known, and therefore, cannot be accounted for. In certain cases, regional variations in travel-time curves are present across a network, resulting in severe bias in epicenter locations for which corrections were not made.

HERRIN, E., Revision to HYPO Digital Computer Program for the Determination of Earthquake Hypocenters, Contr. No. AF-AFOSR 414-63, Southern Methodist Univ., Dallas, Texas, 1961.

VESIAC 7735 VU

Reported upon is extensive testing of HYPO. It is stated that all the important errors in the program itself have been corrected; also, reports of the previous year have been corrected. Revised station codes and constants are printed, and several additions to the original HYPO program are discussed. The revision also contains a new list of input-output routines and a description of an automatic executive routine. This routine significantly reduces programming time and makes it possible for an inexperienced operator to run the computer during production runs. Methods are suggested for reducing the running time of the HYPO to a fraction of that necessary a year ago. Programming flexibility is retained; technical problems are minimized.

HERRIN, E., Selection of Twenty Five Soviet Seismic Stations, Contract No. AF-AFOSR 414-63, Dallas Seism. Observ., Dallas, Texas, 1963.

VESIAC 6196 VU

The staff of the Dallas Seismological Observatory was asked by the U. S. Arms Control and Disarmament Agency to select 25 Soviet seismic stations from a list of 73 fixed seismic stations in the USSR. This report lists the 25 selections, the criteria for selection, their coordinates and descriptions of their equipment. At least one station is within 100 km of all known seismic areas in the USSR. Most of the seismic areas are covered by two or three stations at first zone distances. All permanent stations east of longitude 80° E were selected in order to give reasonable geographic distribution. Stations west of 80° E were chosen primarily because of the type of equipment known to be in use in 1960.

HERRIN, E., Studies to Improve Techniques for the Determination of Seismic Epicenters and Focal Depths, Final Rept., Contract AF-AFOSR-414-63, Southern Methodist Univ., Dallas, Texas, 1965.